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Section of Dermatology

President—H. HALDIN-DAVIS, F.R.C.S.

[*February* 17, 1938]

Sclerodermia with Hypertension.—PHILIP ELLMAN, M.D. (introduced by F. PARKES WEBER, M.D.).

J. G., aged 49, a baker. Admitted to the Rheumatic Unit, St. Stephen's Hospital, as a case of ? rheumatoid arthritis.

History.—Eighteen months ago a patch of erythema appeared on the left thigh, and this was followed by pain and stiffness in both thighs. Within a few weeks the pain and stiffness extended to the lumbar region, and then, more slowly, up to both shoulders, down the arms to the hands, and up to the jaw. A year ago the patient could walk a mile, but now he can only walk 40 yards, and the joints are becoming contracted, so that he cannot stand upright or extend his fingers. On any movement the muscles become hard and the taut skin limits all joint movements. Otherwise he feels well; has no headaches, or giddiness. Loss of sexual power for one year. No past illnesses. One brother has Graves' disease.

Condition on examination.—Healthy-looking man. Skin: Soft and not scaly except for area of glistening erythema on outer side of both thighs and of right leg, bound down to underlying tissue. Blood-pressure 220/130. No other abnormality. X-ray examination: Heart not enlarged; normal in shape, size, and position. Aorta normal. Bones show general decalcification.

B.S.R. 2% (Westergren). Wassermann and Kahn reactions negative. Blood urea 45 mgm.%. Blood uric acid 2·2 mgm.%.

Blood-count: R.B.C. 6,880,000; Hb. 112; C.I. 0·82; W.B.C. 7,000 (polys. 57%; lymphos. 29%).

Electrocardiogram: Curves normal in all leads.

Treatment: Thyroid, gr. i, b.d. Olive-oil massage; gold; fibrolysin; tab. pantesin t.d.s.

1 c.c. doryl, b.d.—produced sweating, which he had not had before, and flushing, but no skin improvement. Doryl ionization produced good sweating effect.

Discussion.—Dr. ELLMAN said that he was present not as a dermatologist but as a general physician. He would be grateful for assistance with regard to the treatment of the patient. It had been suggested that the case was not one of sclerodermia but of dermato-mycosis. He was not sure whether there was any appreciable difference between those two diseases.

Dr. F. PARKES WEBER said he did not think that the case was typical of any form of dermato-mycosis. The connexion of generalized sclerodermia with high blood-pressure had not been much noted in the literature, but was probably not very rare. The history of this case suggested some disturbance in the endocrine glands and one knew that in various endocrine disturbances, notably in myxœdema, high blood-pressure was not uncommon; moreover, it had often been suggested that in some of the cases of generalized sclerodermia a disturbance of the thyroid gland function was present.

Dr. F. SHERRY-DOTTRIDGE said that she had seen a case somewhat similar in its commencement. The patient had given a history of burning pain and indurated plaques in the lower part of both legs. This had occurred two years after ligature of the right and left thyroid arteries on account of Graves' disease. During the past two years, however, the pain

and induration had gradually subsided, leaving only scattered indurated areas in the subcutaneous tissues. The patient had been treated with di-iodotyrosine.

Dr. H. W. BARBER said he noted that one of the patient's brothers had Graves' disease. He thought the most helpful treatment in the case under discussion would be to give iodine with the thyroid. He had seen cases improve when so treated.

Dr. A. M. H. GRAY said that evidence of thyroid disturbance in cases of sclerodermia was extremely weak. Apart from a few cases associated with myxœdema or Graves' disease, the majority of cases of sclerodermia did not appear to have any demonstrable disturbance of the thyroid. Massage was by far the most important line of treatment in these cases, possibly combined with various methods for inducing sweating.

Morphœa.—F. SHERRY-DOTTRIDGE, M.B. (for R. T. BRAIN, M.D.).

Mrs. A. C., aged 67, had, when seen about eighteen months ago, a large oval plaque on the right side of the neck, which she had first noticed four years previously. The plaque had a wrinkled, white, parchment-like surface and the lower edges were vesicular and showed a pinkish lilac border. The vesicles were sterile on culture and had disappeared when the patient next attended. The plaque is gradually increasing in size and becoming more irregular in shape along the borders where the lilac margin has been absent.

The rest of the body is clear except for a small circular shiny white spot on the right thigh and scattered pearly white spots on the back of the neck.

Wassermann reaction negative. Blood-count normal. Blood-calcium 12·48 mgm. per 100 c.c. (raised).

Discussion.—Dr. F. PARKES WEBER said he thought that, clinically, this was a case of white-spot disease or patchy morphœa guttata, although some of the patches were larger than those seen in typical morphœa guttata. The most typical spots were those on the left side of the neck. He would not, however, maintain that the case was not one of lichen sclerosus, because he thought such cases constituted a group which was being separated out from the morphœa and the white-spot group.

Dr. G. B. DOWLING said he thought that there was a clinical difference between the condition in this case and white-spot disease of the ordinary type. The patches appeared to have fluid beneath them. In the microscopical section shown there appeared to be a space beneath the epidermis from which the collagenous tissue had disappeared. The same intense subepidermal œdema had been present in a case shown for him (the speaker) in 1936 by Dr. W. K. Myers, and in one shown later by Dr. R. Klaber. The breaking-down of the central portion of the larger lesions had also been seen in the case shown by Dr. Myers. Whether lichen sclerosus was a variety of sclerodermia or not, he thought that the clinical and histological characters of the condition were sufficiently striking to make a special designation desirable.

Dr. H. MACCORMAC pointed out that the tongue was curiously altered—a fact which was suggestive of lichen planus.

Sclerodermia.—F. SHERRY-DOTTRIDGE, M.B. (for R. T. BRAIN, M.D.)

Mrs. M. Y., aged 35, noticed, fourteen months ago, a slight irritation and scurfy patch on the outer side of the left forearm. Gradually the skin in this area became white, shiny, hard, and attached to the underlying structures. About four months later similar plaques appeared on the outer side of the arm just above the elbow. Three months ago symmetrical circular plaques appeared on the back of both hands. These are more superficial and parchment-like and do not irritate. There are also numerous small white spots scattered over the left shoulder. For the past five months it has not been possible to extend the left elbow fully.

Wassermann reaction negative. Blood-count normal. Blood-calcium 10·3 mgm. per 100 c.c. (normal).

Four very septic stumps of teeth have been removed.

Small doses of X-rays stopped the irritation for a few weeks. The patient has been having thyroid and radiostoleum and is now having liver extract. The condition appears to be spreading.

Pemphigus Foliaceus.—A. M. H. GRAY, C.B.E., M.D.

Phillis P., aged 17, has a generalized eruption which began when she was aged 13½ years with some small blisters on the front of the chest. These blisters burst and left a red, scaly patch which spread over the front of the chest on to the shoulders and back, and gradually involved the neck, face, scalp, and limbs. The nails have been shed on several occasions.

She has been in University College Hospital since January 1936. During that time the whole of the body has been covered with a red, scaly eruption. The scales are large ; they separate freely and are of a greasy character. Often there is slight exudation and thin crusts form. The skin gives out an unpleasant odour. The hair is thinned and the scalp is often covered by fairly thick crusts. The only parts of the body in which the eruption differs from this have been the hands and feet, which have areas of apparently healthy skin but also numerous circinate areas showing a smooth centre and a scaly collarette. These have varied considerably in number, sometimes covering the whole of the backs of the hands and feet, sometimes being present only to a slight degree. A few of these lesions also occurred on the palms and soles. The nails have never fallen out during her stay in hospital. On admission they were striated and brittle, but are now more or less normal in appearance and fairly healthy. She has occasionally had small inflammatory patches in the mouth but no definite blisters.

Nikolsky's sign is marked and the horny layer tends to come away wherever there is any pressure. The blood-count shows nothing remarkable though there has been a slight eosinophilia throughout her stay in hospital. "There is a slight superficial keratitis of both eyes" (Mr. C. D. Shapland). The teeth were rather septic ; since admission ten have been extracted.

She has had a considerable variety of treatment, both external and internal. For the last two months she has been having injections of germanin, 0·2 gram every ten days, and the skin seems to have improved during this period. For local treatment she is having bran baths, and zinc oxide and starch powder to the greater part of the body, with occasional applications of calamine liniment containing mitigal. Occasionally liquid paraffin is used when the dressing is inclined to stick. The general health is excellent.

Pemphigus of the Senear-Usher Type.—A. M. H. GRAY, C.B.E., M.D.

Mrs. F. L., aged 59, has had an eruption on her face, scalp, and trunk, for about three and a half months. The eruption began with irritable spots under the left breast ; these have since spread, coming out in crops in various parts of the body, chiefly on the trunk, face, and scalp. Some of them appeared as blisters and others as moist red spots.

The eruption occupies the face, neck, scalp, trunk, and limbs. The hands are quite unaffected and only one or two lesions are present on the right foot. On the face the rash is most marked over the cheeks, nose, and forehead ; the neck is almost completely surrounded, the rash extending on to the chest. On the trunk it occurs partly in fairly large patches, noticeably under the breasts, but also in numerous small nummular lesions. The limbs are similarly affected, the rash becoming less marked towards the extremities. There are a number of small discoid lesions in the scalp.

The character of the lesions is similar throughout, consisting of sharply-defined,

red, scaly areas surmounted by greasy scales and, in some cases, by thin crusts. The earliest lesions can be seen to begin as small red papules, smooth on the surface, which develop into flaccid vesicles, the surface of which soon rubs off, leaving red scaly areas.

This case presents a very curious Nikolsky sign, something I have never seen before and which might be worth watching for in such cases. If the skin over the area somewhere near one of the lesions is pressed hard, the skin does not come off over the whole of the area which is pressed, but a small area exfoliates in the middle of the patch. I do not know whether anybody else is familiar with it; it is interesting in view of the type of eruption in this case. There is, however, a general tendency to produce the Nikolsky sign, as shown by the fact that when a biopsy was carried out and strapping was applied, the skin over that area exfoliated when the strapping was removed.

The patient complains of cough, and X-ray photographs show some congestion of the base of the left lung and some enlargement of the mediastinum. This condition is still under observation by Dr. Morland. The blood-count is comparatively normal and no other investigation has revealed anything abnormal.

The condition is steadily spreading in spite of the internal administration of arsenic and of local treatment.

I show this and the preceding case together as I believe them to be variations of the same condition. I think it will be agreed that the first is one of classical pemphigus foliaceus, though it is unusual for this to occur at so young an age.

This second case seems to me a typical example of the Senear-Usher syndrome. The characteristic lesions are groups of flaccid bullæ which are not always obvious and in which the bullæ rupture and eczematous areas are left behind. These are quite different from the areas left when ordinary pemphigus bullæ rupture. In the latter case there is an ordinary raw area; in these cases an eczematous area is left, of exactly the same type as that in pemphigus foliaceus.

There are other points of similarity between these two conditions. Although in pemphigus vulgaris lesions do occur on the face, I do not think anybody would say that lesions on the face were predominant; yet in these cases the face seems to be particularly picked out.

I have had under my care only one other Senear-Usher case, and in that, as in the second case now shown, the lesion actually began on the trunk—in one case on the back and in the other under the breast. In the first case now shown the pemphigus foliaceus also began on the trunk; very soon the face was attacked rather extensively. This is unlike the normal evolution of a case of pemphigus vulgaris.

The first case of pemphigus foliaceus I came across had a seventeen years' history. At the Meeting of the British Association of Dermatology in Edinburgh, in 1937, two cases of many years' standing were shown. Ormsby records cases of the Senear-Usher type with fourteen years' and eight years' histories. As regards duration, therefore, the two diseases seem to correspond.

Another point is that in both cases the general health seems to be entirely unimpaired. It is true that in the later stages it may fail as a result of the disease, but the length of time for which patients keep perfectly well is amazing. For instance, the patient who had pemphigus foliaceus for seventeen years went out of hospital and did an ordinary day's work.

Nikolsky's sign seems to be an absolutely characteristic feature of both diseases. Altogether, there are so many points in common between these two types of disease that I cannot help thinking them to be really one and the same. There are many other points that will have to be investigated, but I would suggest that the Senear-Usher syndrome is really a localized form of pemphigus foliaceus and is not, as some have thought, a form either of seborrhœic dermatitis or lupus erythematosus, nor has it any particular relation to pemphigus vulgaris.

Discussion.—Dr. W. FREUDENTHAL said that a biopsy of a lentil-sized lesion from the back showed definite blisters. The vesicles were subcorneal or, more precisely, under the stratum granulosum, many of them filled with fibrinous masses. Their tops were so thin that one could easily understand how they were rubbed off by the slightest trauma. That had actually happened in the middle of the lesion where the horny layer was missing, leaving a spongiotic and acanthotic epidermis. In its place there was a fair amount of infiltrate in the papillary body and permeation of cells through the epidermis. In other places the infiltrate was very slight.

Even on the borders of the section, which clinically looked normal, very superficial vesicles were seen histologically. That suggested that in the neighbourhood of the lesion a positive Nikolsky's sign could be elicited. Indeed, when the plaster retaining the dressing over the biopsy wound had been removed, pieces of horny layer came off with it.

Dr. F. PARKES WEBER asked if the presence of large bullæ in a case of pemphigus was not a sign of the severity and acuteness of the lesions? Was it not a fact that in most cases progress was much worse when there were large bullæ than when there were no obvious (macroscopic) blebs or vesicles?

Dr. NORMAN BURGESS asked whether Dr. Gray regarded pemphigus foliaceus and pemphigus vulgaris as different diseases or as sub-varieties of the same disease? He (Dr. Burgess) had a case under his care in which there were tense bullæ, and a bat-wing distribution on the face. It was undoubtedly one of pemphigus vulgaris, but the lesions on the face resembled those of the Senear-Usher syndrome.

Dr. G. B. DOWLING asked whether blisters occurred in the mouth in the two conditions under discussion.

Dr. H. W. BARBER said that the possible relationship of the Senear-Usher syndrome to pemphigus foliaceus had not previously occurred to him. He wondered whether Dr. Gray had ever known a case of true pemphigus foliaceus recover. Personally he did not think there was any connexion between pemphigus foliaceus and ordinary pemphigus vulgaris.

With regard to the Senear-Usher syndrome, some years ago he had watched over a long period a case with a rather interesting history. The patient had come to him after having sun-bathed. The back and the front of the chest were covered with crusted lesions resembling impetigo. The crusts disappeared, and were succeeded by lesions which looked like seborrhœic dermatitis. Lesions, clinically indistinguishable from erythematosus, had then developed on the malar regions and on the scalp. He (Dr. Barber) had come to the conclusion that the case was one of the Senear-Usher syndrome. The patient had recovered after being under treatment for some years; the condition had appeared to respond to injections of gold.

Dr. GRAY (in reply) said he agreed with Dr. Barber that pemphigus foliaceus was a definite clinical entity. The difficulty was that one saw a certain number of cases which appeared to be intermediate forms, but when a clear-cut case was seen the differences were so great that one felt that pemphigus foliaceus must be regarded as a separate disease. He had not seen a case of pemphigus foliaceus recover. The disease was extremely rare; he had had under his own care only two typical cases and did not think he had seen more than six cases in all.

In reply to Dr. Dowling: The patient with pemphigus foliaceus had had no very obvious blisters; but there were eroded patches which recurred; he had not found these in either of his two Senear-Usher cases.

In reply to Dr. Parkes Weber: He did not think that the size of the bullæ was a criterion as to severity. It must be some other special characteristic of the disease which kept the bullæ intact.

With regard to treatment: The Senear-Usher case which he had previously seen, had been progressive for a considerable time. Six months ago he had suggested trying small doses of germanin and that had had the effect of entirely stopping the progress of the disease. The patient in the second case now shown had been treated with arsenic for five weeks, but the condition was steadily spreading. Last week an injection of 0·2 grm. of germanin had been given; the lesions under the breast had cleared up and the progress of the disease, so far as the face was concerned, had for the moment been checked. In the case of pemphigus foliaceus small doses of germanin had been also injected during the last few weeks and the

patient had certainly been better during that period. This meant that more smooth epithelium had developed, but as that had happened to a certain extent so often—though not to the same extent as on this occasion—he could not yet claim any definite result. There was, however, no doubt as to the benefit produced by small doses of germanin, which had had a marked effect in two cases of the Senear-Usher type.

? Senear-Usher Disease. Case for Diagnosis.—LOUIS FORMAN, M.D.

C. C. O., male, aged 46, was sunburned while at the seaside three and a half years ago. The whole of his face became red and swollen for two days. After the swelling had settled down there were red pustular spots all over the face, and these were treated as impetigo.

In January 1936 the patient came under the care of Dr. Robert Klaber, to whom I am indebted for the following information. There were well-defined red scaling patches, scattered with pustules, on the forehead and neck. Eight fractional doses of X-rays were given and there was considerable improvement. Dr. Klaber noted that at one time there were grouped vesicles on the red patches.

January 1938: There was a sharply limited, red, slightly œdematous plaque showing numerous pustules over the forehead. Under the chin there was a large red area which was sharply limited and showed slight atrophy. Over the shoulder were small deep red patches, many of which showed pustules. The skin over the terminal phalanges was erythematous, but there were no definite atrophic or vesicular changes. Blood-count normal. Pustules sterile.

Report on microscopical sections.—Forehead: Epidermis shows considerable œdema and vesicle formation, and, in one area, a definite blister, formed by detachment of the horny layer. Other areas of the epidermis showed parakeratotic scales which included polymorphonuclear cells. The papillæ were widened and there was œdema and dilatation of the capillaries. There was uniform infiltration of mainly lymphocytes. The elastic tissue was particularly well preserved in the papillæ. There was a narrow œdematous band between the basal layer of the epidermis and the elastic network. A rather similar appearance was noted in the section from a patch on the back.

The histological appearances are against a diagnosis of psoriasis or lupus erythematosus.

Discussion.—Dr. FORMAN: Dr. Gray has covered the ground in his remarks on the Senear-Usher disease. I look upon Senear-Usher disease as a variety of pemphigus but peculiar in that the lesions are localized and that the blisters tend to relapse on a permanently inflamed area of skin. I think that at one stage, the Senear-Usher syndrome must be closely similar to lupus erythematosus, as this disease is included in the differential diagnosis of many discussed cases. It seems that some cases have not a grave prognosis; they have been reported to improve after four years. I do not think this case is one of pyodermia; the pus was sterile and the contents of the blister fluid did not suggest an impetigo lesion. The case fits in fairly well with the published cases of Senear-Usher. Authors have noted that although clinically there appear to be no vesicles, histological sections show epidermal vesicles and blisters to be constantly present.

Dr. A. M. H. GRAY said he did not think that this case fitted in with a Senear-Usher syndrome. The Senear-Usher eruption was extraordinarily symmetrical, especially on the face. The section did not seem to him to be quite similar to that in his own case. The collections of fluid in Dr. Forman's case seemed to be actually just under the horny layer or even in the horny layer itself, whereas in his (Dr. Gray's) case it was quite clear that the blister began in the malpighian layer; the granular layer, and a few cells below it were adherent to the outer wall of the vesicle, which seemed to be on a lower level. The vesicles in Dr. Forman's case seemed to correspond more to the vesicles seen in impetigo. He thought that the case was one of some form of chronic pyodermia rather than of a Senear-Usher type.

? Kaposi's Disease. Case for Diagnosis.—A. C. ROXBURGH, M.D., and ROBERT KLABER, M.D.

Mrs. M. K., aged 73 (shown by permission of Dr. George Graham). Both parents were Scottish; the patient was born in Durham.

History.—Fifty years ago: Pulmonary tuberculosis. Cough, sputum, and loss of weight, for five years. She then went to South Africa for six years, where she made a complete recovery, and then returned to England. While in Capetown she visited a leper island, for one day only, but has not had any other contacts with that disease.

Thirteen years ago: Thirst, polyuria, and loss of weight. Glycosuria was discovered and persisted, in spite of a diet. Three years ago: Pneumonia. While convalescent, first noticed "blackheads" on the backs of her legs and arms. She says these could be rubbed off in her bath. Fresh lesions, however, continue to appear, and when erupting are associated with stinging sensations, which soon subside.

Condition on examination.—An intelligent woman; well preserved.

Face (figs. 1 and 2): The ears, eyebrows, central forehead, and cheeks show deep purple-brown plaques, heavily infiltrated, with additional yellowish nodules within the affected areas. Similar purple-brown nodules are also present on the chin and nose.

Trunk: The back shows several residual, flat, pigmented areas. The breasts show brown plaques, slightly infiltrated, containing a few very small ? pustules.

Arms: There is an extensive, reticulate eruption on the back of the arms, showing purple circinate and polycyclic infiltrations on a flat brown pigmented base. These infiltrated elements appear suddenly and may or may not disappear within a few days. On the left elbow one of the older lesions has become infected, and resulted in an enlarged axillary gland. No other glands are palpable. *Staphylococcus aureus* only was recovered from the pus. Hands (fig. 3): Infiltrated mauve lesions are present on the ulnar borders of hands, overlying the knuckles, and on the dorsum of some of the terminal phalanges. Legs (fig. 4): Infiltrated plaques are present on the knees. Feet: Red scaling infiltration is present on the soles extending on to the outer border of the feet.

Spleen not palpable. Liver: Lower border firm and suggesting some enlargement. Urine, after treatment by diet, is now sugar-free. Mucous membranes: Nothing abnormal discovered. Wassermann and Sigma reactions negative. Blood-cholesterol 150 mgm. per 100 c.c. Blood-sugar 142 mgm. %.

Blood-count showed a secondary anæmia. Hb. 65%; W.B.C. 4,400 (polys. 2,464; lymphos. 1,936).

Histology.—A large nodule was excised from the right ear lobule.

(1) Section stained with potassium ferrocyanide and hydrochloric acid shows a substantial part of the pigmentation to be due to hæmosiderin.

(2) Frozen section stained with sudan IV and hæmatoxylin shows no gross lipoid infiltrate, and excludes any form of xanthomatosis. There are, however, a few small areas showing extracellular lipoid granules (? lipo-fuchsin).

(3) Ziehl-Neelsen serial sections showed no acid-fast bacilli and exclude the nodular form of leprosy.

(4) Hæmatoxylin-eosin sections show an extensive young connective tissue-cell infiltrate, associated with, and perhaps directly related to, much new capillary formation.

(5) Further sections from a very young circinate lesion on the arm show more striking vascular and perivascular changes. Numerous new vessels are here seen in a state of acute inflammation and degeneration. Surrounding these is a curious network which may be formed by young perithelial cells, already showing advanced vacuolar degeneration, with scarcely perceptible nuclei. Professor Hadfield, however, who has kindly seen this material, suggests that the appearances might result from

infiltration with some chemical material, the nature of which it has not yet been possible to ascertain.

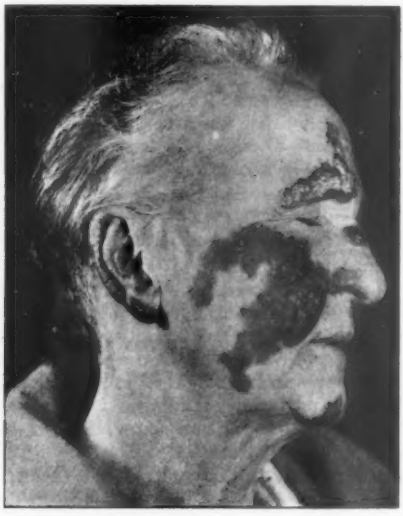

FIG. 1.

FIG. 2.

Discussion.—Had this patient been a male, and a Polish Jew, one would probably not have hesitated to diagnose Kaposi's disease. Because she is a woman and, has

already had diabetes and tuberculosis, a special effort has been made to exclude any condition which might be related to these. Syphilis and leprosy have also been considered and may probably be excluded.

FIG. 3.

FIG. 4.

FIGS. 1 to 4.—Kaposi's Disease. Mrs. M. K. (Dr. A. C. Roxburgh and Dr. Robert Klaber.)

The clinical and histological findings seem to us to fit more closely the descriptions of the disease described by Kaposi than any other known condition.

Kaposi's Disease.—A. C. ROXBURGH, M.D., and ROBERT KLABER, M.D.

R. F., male, aged 41, born in London of Jewish parents from Eastern Europe. He enjoyed good health. 1916 : Trench feet on Somme. 1928 : Appendicectomy.

He came to hospital complaining of discoid eczematous lesions which first appeared three years ago on the perinæum and later on the forearms, forehead, and ears. The eczema has diminished considerably since X-ray treatment. During the course of examination, however, certain other lesions were observed. Of these, he thinks the first to appear, about eight or nine years ago, was a swelling in the left axilla (fig. 1). This had gradually increased in size but has never been painful. It is a large, firm mass, about the size of a hen's egg, not attached to the skin, but adherent to the deeper structures. Some time after the appearance of this mass, he became aware of

FIG. 1.

a number of purple nodules on the toes and feet. These have gradually increased in size and number; they occasion no irritation or pain and he has paid little attention to them.

Condition on examination.—On the right middle toe, and also immediately proximal to it, are coalescent groups of raised purple, firm, smooth, discrete nodules, covered by a thin loose scale (fig. 2). The nail of this toe is grooved and largely occluded by two superimposed angiokeratomata, growing from the superficial aspect of the nail-fold.

Several other lesions of similar deep purple colour are present on the feet, though these are less nodular. Three parallel band-like lesions are seen on the outer side of the dorsum of the left foot, ranging from 1 to 3 in. in length (fig. 3).

FIG. 2.

FIG. 3.

Figs. 1 to 3. Kaposi's disease. -R. F. (Dr. A. C. Roxburgh and Dr. Robert Klaber.)

Histology.—Sections show marked numerous new vessels with marked obliterative changes and wide areas of perivascular proliferation.

Kaposi's Disease.—ROBERT KLABER, M.D.

This case was shown at a meeting of the Section in 1933 as a "case for diagnosis" (*Proceedings*, **27**, 145, Sect. Derm., 9). Dr. Parkes Weber indicated that it was one of Kaposi's so-called idiopathic hæmorrhagic sarcoma, which was supported by further biopsy. Treatment with various forms of arsenic by mouth, novarsenobillon, enesol, and X-rays both to early and later lesions, was without any appreciable effect. New nodules continued to appear, while several of the older areas became at first thickened and later showed involutionary changes.

I lost sight of the patient for eighteen months—till August 1935—when he returned to the Prince of Wales's Hospital and reported that he had attended four other hospitals, where he had received gold injections and further doses of X-rays without any benefit. He had also been inoculated with malaria, and immediately afterwards the condition had spread rapidly to new areas.

Present condition (2.2.38).—On both hands and feet there are extensive sheets of deep lilac-coloured œdematous infiltration which is easily depressed. On the forearms and legs are numerous discrete round or oval lesions, of similar character. On both ankles there are areas in which the œdema is of such degree as to be almost bullous in character. On the right buttock a few new nodules have appeared within the last few months.

Elsewhere there have been no new lesions. The present appearances suggest that involution has proceeded further in the course of the last five years.

His main trouble now arises from eczematization, especially in groins, scrotum, and ankles. The distribution and appearances in some of these areas are suggestive of seborrhœic eczema and have been partially relieved by fractional doses of X-rays.

Histology.—The appearances in the upper part of the skin are not very striking. They show only fibrosis and a slight degree of perivascular small round-celled infiltration. In the deeper parts of the cutis, however, there is some formation of new vessels with obliterative changes and perivascular proliferation. Sections from this case which were obtained when the condition was already involuting, show the difficulty which may be met with in obtaining histological confirmation of the diagnosis of Kaposi's disease.

Discussion.—Dr. F. PARKES WEBER said there could be no doubt as to the diagnosis in the second and third of these cases; they were both typical of Kaposi's disease, certainly so far as naked-eye examination went. What was the deep subcutaneous swelling in the left axilla in the second case? He had never seen any swelling of that kind in connexion with Kaposi's disease.[1]

In regard to the first case Dr. Klaber had said: "Had this patient been a male, and a Polish Jew, one would probably not have hesitated to diagnose Kaposi's disease." He (Dr. Weber) certainly did not at all agree with that. He thought that Kaposi's disease was the most unlikely diagnosis from the macroscopic appearances. But what was it? He took it that it belonged to the so-called infective granulomata group, which included tuberculosis, leprosy, and such diseases, but not Kaposi's disease. The case reminded him of that of a Russian woman aged 66, shown by him to the Section a good many years ago (June 1917). She had been in England and resident in London for ten years, and had lesions on the legs of which some of the lesions in this case reminded him, to some extent, macroscopically. He had her shown with a biopsy which was illustrated in the *British Journal of Dermatology*, 1917, **29**, 202, as probably a kind of xanthomatosis. None of the members of the Section had then suggested anything else. About two years later (F. Parkes Weber, *Proc. Roy. Soc. Med.*, Dermat. Sect., 1919-1920, **13**, 12), there could be no doubt whatever that the case was one of leprosy. When a second biopsy was made the sections swarmed with leprosy bacilli. Little eye lesions had developed, and an ophthalmic colleague had said he had never seen anything like them except in cases of leprosy. On the whole (including the patient's eye trouble) the condition strongly suggested leprosy, and he advised that another biopsy be made, perhaps from another type of lesion.

[1] In regard, however, to changes in lymphatic glands in some cases of Kaposi's disease, *see* O. Kren, in Jadassohn's *Handbuch*, Band xii, Teil 3, page 968 (1933).

Professor BALLINA (speaking in French) said that in his opinion the case just discussed was not one of leprosy; he had not seen a similar type of lesion in any case of leprosy. The present case was certainly very interesting and rare, and therefore difficult to diagnose.

Dr. KLABER (in reply) said it was interesting that Dr. Parkes Weber should so strongly favour the diagnosis of leprosy, because the possibility of this condition had been seriously considered. The ear lobule, however, had been specially selected for the site of the first biopsy, in the belief that if any leprosy bacilli were present in the skin, they would be found there, but none had been found in serial sections obtained from this source. The absence of *B. lepræ* in the ear lobule probably excluded nodular leprosy. In spite of this, however, nasal mucus had been searched for acid-fast bacilli, with negative results. No thickened ulnar nerves were palpable and no signs of diminished cutaneous sensation could be discovered by Dr. Hunt.

Dr. W. FREUDENTHAL said he thought that the histological investigations should be continued. In various parts of the section shown under the microscope there was a faintly bluish network the nature of which should be ascertained. A more recent lesion should be stained for fat because the fat sometimes disappeared from old xanthoma lesions.

Miliary Lupoid.—H. W. BARBER, M.B.

H. H., male, aged 74, worked in a cement factory for thirty-one years from the age of 22. During the war he was employed at the docks, and subsequently worked for twelve years on the roads. He has suffered from chronic bronchitis for some time, and he had an acute attack in October 1937. He states, however, that the lesions began to appear on his face about a fortnight before this.

There are a large number of lupoid papules and nodules on the face, chiefly affecting the rosaceous area: some are present on the eyelids and, when I first saw him, there were some on the lobes of the ears also.

Investigations.—(1) A radiogram of the chest shows diffuse fibrosis, chiefly of the bases of the lungs: large "roots" with glands. (2) Repeated examinations of the sputum have failed to reveal tubercle bacilli. (3) A test meal shows hyperchlorhydria. (4) Microscopical appearances of an excised nodule are typically tuberculous.

Ulceration of the Scalp.—CLARA M. WARREN, M.R.C.S., L.R.C.P.

Mrs. E. C., aged 58. The lesion has developed slowly since its first appearance as a scar twelve years ago. It was attributed by the patient to a blow on the scalp thirty-four years ago. After having had pain for many years she was examined by X-rays fourteen years ago, with a negative result.

The surface now shows healing areas, but if it is touched it is very painful.

No neurological signs have been discovered. Pathological investigation included a negative Wassermann reaction, and no agglutination with the typhoid group. A direct smear grew staphylococci only. A skiagram of the skull showed no bony abnormality.

A similar condition was observed in another patient, at about the same time, who stated that she had had an ulcerated scalp for more than forty-five years, following a blow on the head.

Discussion.—Dr. G. B. DOWLING said that two similar cases had been shown at meetings of the Section, one by himself, the other (he thought), by Dr. Twiston Davies. In both the diagnosis had been thought to be dermatitis artefacta. In the present case the lesion was at first the result of an accident, but the patient had told him that it had become worse during a period of domestic worry.

Dr. WARREN (in reply) said that the possibility of an artefact had been considered but the woman was of a very nervous temperament and there did not seem to be any reason for the artefact to have developed. Someone had suggested that the ulceration might be due to

an X-ray burn, but as far as could be gathered, skiagrams had only been taken with a view to discovering whether there was any bony injury, and for that purpose the patient should not have been under the rays for more than a few moments on each occasion.

Hypo-ovarian Dermatosis, Responding to Œstrin.—ALISON N. MACBETH, M.B. (by permission of MARGARET BASDEN, F.R.C.S.).

Mrs. I. H., aged 35. This patient's skin lesions can be interesting only in regard to the circumstances of their appearance and disappearance. She first came for advice at the age of 32 when contemplating marriage. She had never had a menstrual period, but pubic hair had appeared at about the age of 22, at which time she began to suffer from cold hands and feet, with chilblains. Later an inconstant "rash" developed on the forearms and shins, more especially on the right side, beginning as a raised red patch which was irritable and was relieved by scratching until it bled.

Examination, which induced hysterical convulsions, showed that sexual development was very incomplete; mammary glandular tissue was minimal, as in the male: axillary hairs few in number, weak, and unpigmented; pubic hair normal; vulva unpigmented and infantile, vagina small but of normal proportions, uterus palpable only as a cervical dimple. The skin was white and fine except on the face and extremities, where it was blotchy and very cold; the hands were as blue as bilberries, the feet very cold and white. Her mother's puberty is said to have been delayed till the age of 18, after which she was normally fertile.

Treatment.—Parenteral œstrogenic therapy was given, for general reasons, over three periods of observation, once in 1936 and twice in 1937, as 5 mgm. œstradiol benzoate, repeated every three or four days. On all three occasions the response was the same: profound alteration in mental outlook beginning after about twenty-four hours; breast activity becoming marked in the second week; disappearance of the Raynaud phenomenon, and resolution of the condition affecting the skin of the forearms and legs at the end of the fourth week of treatment. Interruption of treatment always led to from two to four days' uterine hæmorrhage seven to twelve days after the last injection, after which the patient would remain in good health and spirits, without skin changes, for a further period of about twenty-five days, and then begin to relapse, regression being complete a few weeks later.

Recovery and relapse having occurred three times, in autumn, summer, and winter conditions, the connexion with treatment seems clear. The relationship of Raynaud's disease to gonadal insufficiency appears to be accepted in the literature, and it is therefore suggested that the lesions on the forearms and shins may be similarly determined, since both these and the Raynaud phenomenon clear up at the same stage of treatment, i.e. some three weeks after the general physiological and psychological improvements have set in.

Dr. F. PARKES WEBER said he thought that the itching lesions which the patient described as occurring from time to time on her forearms were allied to urticaria. Sometimes there was swelling and possibly typical urticarial weals appeared. Itching lesions of the kind on the forearms might disappear after a holiday and a general improvement in mental and physical condition.

Section of Laryngology

President—C. A. Scott Ridout, M.S.

[*March* 4, 1938]

DISCUSSION ON THE VALUE OF PHYSICAL METHODS IN THE TREATMENT OF SUPPURATIVE CONDITIONS OF THE NOSE AND THROAT

A. M. Zamora (*abbreviated*): It has always been the practice of rhinologists to supplement their operations by efforts to repair defects in general resistance, by vaccines, oral administration of tonics and vitamins, and local applications of antiseptics. There is a certain amount of justice in the claim that certain physical agencies may be a sort of portmanteau means of correcting all deficiencies, and much work has been done to accumulate evidence to prove this contention. Under the designation of Physical Therapy there are a large number of procedures. Titus [1] states that at the Medical Center in New York, 44 different treatments are listed in the department of physical therapy, but that, apart from physiological effects, only three general results are achieved by these treatments, namely, induction of increased heat on, or within, the body—either generally or locally—mechanical effects, and mild chemical effects. Other writers claim other specific effects, including bactericidal action.

Heat production is by far the most important result, and the main concern is with sources of heat and their possible modes of action, the elaboration of the oldest therapeutic agent in medicine. The chief technical aim has been to achieve penetration of heat into the tissues. The conductive sources of heat, such as foments or hot bottles, are inconstant, irritating, and non-penetrating, since they emit waves which are too long for absorption (14,000 A.U.). Hot air and electric pads can be made constant but are still non-penetrating. These surface applications must not be spurned, for they have a reflex effect on the heat-regulating centre.

To some extent similar, but produced by an entirely different source, are the effects of cold ultra-violet rays, roughly 130 to 3,900 A.U., for these are also absorbed in the superficial layers of the skin and can only act as counter-irritants. Advantages over conductive heat sources are that the source is constant; the erythema which results after a latent period is of long duration and serves to control the dose; that certain general effects occur, the main in a long list being vitamin and histamine activation, increase of hæmoglobin, calcium, phosphorus, iron, and iodine, contents of the blood,

bactericidal and endocrine effects. Most of these claims have been reasonably established. A typical experiment in support is that of Eidinow, who showed [2] that previous prolonged irradiation of rabbits with ultra-violet and infra-red rays increased their resistance against virulent staphylococci, but that similar irradiation after infection had no result.

The electric currents in use for treatment may be divided into low voltage, and high-frequency groups. Of low-voltage currents the faradic and sinusoidal have little application in our subject. The galvanic current is mainly used in connexion with ionization or iontophoresis. Leduc claimed of the zinc ion that there is no wound or ulcer which cannot be disinfected by its employment, provided its surface can be reached by the electrodes. Under the influence of the galvanic current, the zinc ion can be made to enter the tissues from a weak solution of zinc chloride and to form a zinc albuminate with the albumin contained in the exudates, cells, or unicellular organisms. Antiseptic action results from cell death, and a protective coagulum forms on the surface. Except in fulminating streptococcal cases, disinfection *per se* has never held a high place in the treatment of nasal suppuration, but drainage and mucosal repair bring about disinfection. For the urgently acute cases recent discoveries in chemotherapy offer an incomparably greater promise of antisepsis than physical measures. The complexity of the air cells in the upper regions of the nose makes ionization unsuitable, for success is dependent on complete accessibility of the affected area. Further, Hollender's [3] histological studies of mucous membrane after ionization conclusively prove that fibrosis takes place and is accompanied by a permanent loss of cilia. Supporters of the ciliary function of defence will look with disfavour on this effect.

That ionization has a sedative effect on intumescent rhinitis of all kinds has been emphasized by Franklin [4]. It is generally accepted that ionization is not successful in cases in which there is any surgical indication, but that it may hasten improvement after wide operative drainage of the antrum.

Clinically, the use of the quartz mercury vapour air-cooled lamp for general exposures and that of the water-cooled Kromayer lamp with special nasal electrodes are of value.

A variety of lamps and infra-red units emit rays of 5,000 to 14,000 A.U. which have been proved to penetrate the superficial tissues to a maximum depth of about an inch and a half, and to cause an immediate active hyperæmia. These rays are therefore suitable for use in the acute and subacute phase, when drainage has been established. It is found that penetration is greatest at about 11,000 A.U. and at this level valuable sedative and detoxicating effects are obtained. During the painful stages this is probably the most comforting and acceptable type of treatment available. The permeability of these rays is not perfectly known, and it is possible that age, sex, and various conditions of health and disease in the tissues, may be factors which influence penetration.

The discovery by D'Arsonval in 1891 that high-frequency high-amperage currents could be passed through the body without stimulating excitable tissues, has been made the subject of very wide research, for in this discovery many have hoped to find a means of selective influence on a variety of bodily functions. Among agencies evolved from D'Arsonval's original conception are the conventional diathermy, and the so-called short and ultra-short waves.

The essentials of these currents are that, in order to avoid stimulation of excitable tissues and at the same time to produce sufficient heat, they must be alternating, of high density and of a frequency exceeding 250,000 oscillations per second. Technical elaboration has resulted in the production of suitable sustained undamped oscillations of great rapidity (exceeding 100 million in the ultra-short waves), and certainly capable of producing the most effective form of internal heat yet known.

It is persistently claimed by many that high-frequency currents have, outside their heat effects, specific actions of unexplained nature on bacteria, tumours, toxins, and surface tension. Leonard Hill and H. J. Taylor [5] in a recent publication categorically refute these specific effects and ascribe all action to heat. If this is the case, all hope of killing bacteria in living tissues by this means must be abandoned.

The tendency has been to supersede long-wave diathermy by short and ultra-short wave therapy, which means placing of the patient in a condenser field of Hertzian waves of from 30 to 3 metres in length, because these penetrate regions inaccessible to diathermy and the heating is more controlled, uniform, and sustained. Moreover, it is not " shunted " by resistances.

No good method of measuring dosage has yet been devised, and the only criterion is the patient's sensation and a certain artistry on the part of the person applying the treatment. This is a technical detail which probably will be achieved in time, and perhaps Mittelmann's device [10], recently described, may be developed to fill the need. On occasions the patient loses his subjective power of appreciation of heat, and therefore in this respect of measurement of dose, short-wave diathermy has a disadvantage as compared with long-wave, but on the whole the applications are simpler and shorter, and the sensation induced is only that of pleasant warmth.

Good results have been obtained with short waves in conditions of vascular insufficiency such as necrotic states of the skin, and it is the method of choice in treatment of boils and carbuncles. It is doubtful whether this type of action has the same special value in sinusitis, but subacute sinuses with some drainage, and post-operative cases with delayed resolution often derive great benefit from six-metre waves. Cases showing marked fibrosis, however, are made worse, especially as regards pain. The statement is often made that short wave will do good even in the absence of drainage. This is a dangerous doctrine, especially if it leads to omission or delay in applying vasoconstrictor drugs in the region of the infundibulum, or Howarth's blunt dilators, which are often of great value. In the absence of drainage short-wave therapy may lead to increased toxæmia.

It has been emphasized, perhaps over-emphasized, that for acute disease of the upper group of sinuses, operative treatment is rarely advisable. I say over-emphasized, because the few exceptions to this rule are major emergencies, and call for most difficult and important decisions. It is clearly impossible to predict that such an emergency will not arise in any particular case, and therefore an electrotherapist, if in charge of treatment, will be wise to be in close co-operation with a surgeon.

In electro-surgery, high-frequency currents have been adapted for the destroying and cutting of tissues. These methods have long had an indispensable place in general and special surgery. Properly employed, their advantages of bloodlessness, rapidity, and absence of shock and pain, are undeniable. The work of Douglas Harmer and Norman Patterson has fully established their value in neoplastic disease of the nose and throat. In the purely suppurative conditions, however, there are few who favour their use. Norrie [6] reports results of approach to all the nasal sinuses by various electro-surgical methods. The technique is difficult; the formation of sequestra, and the possible effects of thrombosis in an actively septic area, make the method unattractive to most. For reducing turbinal hypertrophies, electro-coagulation and desiccation have obvious applications.

There are a few documented reports of use of X-rays in sinusitis with claims to cure, but there seems little evidence to sustain these claims [7]. Theoretically cell destruction and obliteration of blood-vessels caused by these agents go against the accepted ideals for preservation of immunity. Kisch and Salmond [8] found post-operative sinus pain amenable to medium X-ray in small doses, but produced no effect on the discharge.

Scott-Brown [9], in a recent communication to this Section, presented successful

cases of destruction of nasal polypi of allergic origin by a combination of surgery and radium implantation. He selects non-infective cases for treatment and points out that in suppurative cases no success results. His sections showed extensive submucous fibrosis and thrombosis of small vessels, both undesirable changes in infective conditions.

Mindful of the great developments which, in other spheres, have followed the study and use of certain parts of the electromagnetic spectrum, it is permissible to speculate on the possibility of discovery in the future of some hitherto uncharted band with specific value in the treatment of deep-seated sepsis. At present it seems that helpful physical effects are limited to heat changes which may bring about favourable conditions in the viscosity of secretions and in ciliary activity, and cause detoxication and decongestion.

For established disease, physical measures do not materially alter the classical indications for operation and the problems of treatment remain those of mechanical drainage.

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C. B. Heald : Electrical currents and rays suffer, and have suffered, more from their advocates than from sceptics and opponents. Nothing is so damaging to any new method of treatment as claims which prove to be exaggerated and therefore false.

The most recent examples are the grossly exaggerated claims for so-called short-wave treatment. Advocates of this type of treatment have on many occasions claimed almost universally specific benefit in relieving or actually curing cases of active and acute sinusitis, even when there is a collection of pus and inadequate drainage. It is a good general rule that electrical treatments, with one possible exception, are contra-indicated when pus is enclosed and has inadequate exit, particularly if such pus is in inelastic situations. The contra-indication is stronger if such treatment is liable to lead to congestion, swelling, or risk of interference with the blood supply. The sinuses of the face are good examples of this rule.

The most striking beneficial results have been in cases of recurrent sinusitis of a chronic type, particularly in those where adequate drainage exists or where the chronic nature of the condition means rather that there is an inadequate blood supply to the infected lining mucous membranes. Diathermy can be dismissed in favour of short-wave treatment on the ground of the greater convenience of the technical application of the two currents to the face. I have tried high-powered, low-powered, valve, and spark-gap machines and all kinds of wave-lengths, and I have found the best clinical results from a simple low-powered spark-gap short-wave apparatus. The best results are obtained with short duration treatments and low intensity. This is consistent with the anatomical structure and blood supply of these sinuses.

Another claim made for short-wave treatment is that it will clear boils and

carbuncles in and around the lips and nose in such a way that it should be regarded as the treatment of choice and practically specific. I cannot substantiate these claims unless the short-wave treatment is accompanied by other active means for detoxicating the patient. One such patient, whose general health was undermined by recurrent boils in the ears and nose, gained no relief from these until a blood uric acid of 6·3 mgm. was dealt with appropriately. Another had many short-wave treatments to the sinuses without relief. The removal later of an infected appendix was followed by complete clearance of all sinus symptoms.

It has been claimed that an intensive dose of ultra-violet light to an erysipelas of the face can abort this condition in a few hours. I leave such drastic procedure, with all the attendant risks of further swelling and œdema, to others. One of my oldest friends was, in the belief of a surgeon and myself, killed as the result of an injudicious dosage of ultra-violet light to the face. There is, however, a genuinely useful field for this treatment. Eidinow has shown tnat the hæmo-bactericidal power of the blood can be raised temporarily by radiation of the trunk and legs. Indolent cases of suppuration in nose and throat may therefore be legitimately helped in this way.

The Kromayer lamp is a water-cooled mercury-vapour lamp capable of being fitted with quartz applicators and screens of quartz in which aniline dyes have been incorporated. It is therefore possible to bring a local and concentrated dose from this lamp to bear on tissues not accessible to general radiation. But there is another important feature of the lamp, arising as a result of the water-cooling. The circulating water removes or screens the majority of infra-red or heat rays but not all. A narrow band of these rays of 9,000–11,000 Angstrom units, quite close to the red of the spectrum, is left, and these rays so isolated are particularly potent and effective on lymphatic tissue. That they penetrate thick tissue I demonstrated three years ago when I showed that they were capable of exciting a photo-electric cell after passing through the whole thickness of a forearm.

If these rays are concentrated by quartz rods on congested glandular tissue they produce strong therapeutic effects, as in cases of infected tonsils, particularly of the pale œdematous type, in which adequate reasons against surgical removal exist.

The Kromayer lamp consists of an inverted " U " vacuum burner with the negative arc to the right. For effective treatment from this there must be adequate water-cooling circulation. The lamp must run at as near 280 watts as possible, and any applicators used must be placed in front of the negative arc in their special holders. These applicators must be applied with pressure, so that the tissues are bleached as far as possible. Several types of applicators are available, but those in most constant use are in the form of (1) A curved quartz rod for application to the tonsils ; (2) a straight quartz rod for application to cervical glands ; (3) a thin quartz rod to be used in cases in which there is a permanent opening into the antrum.

The direct current, particularly when small physiological doses are used, is of real value. It can be relied upon to relieve congestion and spasm and to depress the sensitivity of painful nerves, provided there is a wide area of entry and the indifferent or negative electrode is placed at some distance in the direction of the lymphatic stream. The technique to ensure these good physiological results is simple. I have never seen any adverse effects from its employment even in cases where it failed to achieve success. It is the only current I have found safe to use where pus is suspected.

The use of zinc ionization in hay-fever has been widely advertised. Actually zinc has little or nothing to do with successful results, as these can be equally well obtained with ordinary tap-water or weak collosol argentum ; it is the decongestive and analgesic physiological effects of the current that produce these good results.

For those who are not technicians infra-red ray treatment is shrouded in too much

mystery. The homely iron of the housewife when heated to the usual temperature at which she uses it, can under appropriate conditions, provide sufficient infra-red radiation to take an excellent photograph.

A. Eidinow: I wish to bring to your notice a method by which it is possible to get greater penetration than can be normally obtained with ultra-violet rays.

Light treatment is applied by the use of three groups of rays: (1) The infra-red rays, which are the heat rays; (2) the luminous or visible rays; (3) the invisible ultra-violet rays. A great difficulty in the treatment with light is the question of penetration. The greatest penetration through the tissues is obtained with the yellow-orange rays, and this can be easily demonstrated by placing a bright trans-illumination lamp in the mouth, when the rays can be seen coming through the tissues.

In therapy with ultra-violet rays much difficulty is experienced owing to their lack of penetration. These rays will penetrate a little through the tissues, but there they stop. Their bactericidal action takes place entirely at the surface. There are methods by which matter can be sensitized to different rays, and recently, by means of certain dyes, sensitization has been carried out on photographic materials so that we have not only plates which are sensitive to red light or to green light, but plates which are sensitive to infra-red rays and are able to photograph the invisible.

In the living body it is possible to sensitize the tissues to the visible rays by means of dyes. The use of dyes such as erythrosine or rose bengal or hæmato-porphyrin, would sensitize the living tissues to orange, green, and blue rays, and to red rays to a lesser extent. If it were possible to incorporate these dyes in the living tissues it is conceivable that a greater penetration could be obtained with these visible rays which penetrate some way through the tissues. These dyes do not act on the surface of the skin. If eosin, for example, is painted on the surface of the skin, the dead layers of the horny skin act like a piece of red glass which prevents penetration more deeply into the tissues. When, however, such treatment is applied to the mucous membranes in the nose, mouth, and throat, the result is different. Here the layers of cells are not dead, like the horny layers of the skin, in which it is possible to incorporate those dyes by painting on the skin. If we paint the mucous membrane with those dyes and use merely ordinary visible rays, such as are obtained from a transillumination lamp, we can produce effects in the mucous membrane and obtain, as a result, œdema and swelling. It is often possible to get a direct bactericidal action on the portion of mucous membrane which has been sensitized and irradiated.

This opens a new therapeutic field of treatment, because here is a means of securing deeper penetration. The dyes can be used by oral administration or they can be injected by intramuscular or intravenous routes and the whole body will become sensitized. They can be painted on the mucous membrane, though not on the skin surface. The danger, however, of giving these dyes by mouth until an adequate dose is obtained which would cause sensitization, is that the patient may be made ill. The dyes are rapidly excreted, but by oral administration there is produced a long, slow, and steady concentration of dye which may remain in the tissues for twenty-four hours. Intravenous injection is more hopeful, because during the first hour the sensitization effect can be produced.

The indications for such treatment would be chronic pyogenic infective conditions of the nose and throat, especially obstinate lupus in the nose, or on the lips or the palate, and tuberculous ulceration, where there is a great deal of hard fibrous granulation tissue, when adequate penetration with ultra-violet irradiation cannot ordinarily be obtained.

The immediate results of treatment are different from the reactions seen with ultra-violet rays, where erythema and blistering may follow an adequate dose. What usually follows with this treatment, is œdema of the irradiated tissues visible to the naked eye.

H. V. Forster: For many years laryngologists have been interested in the use of diathermy for electro-surgical purposes. The use of this type of current for the development of various kinds of therapy dates from D'Arsonval's experiment in February 1891, and includes Nagelschmidt's introduction in 1907 of a new type of high-frequency apparatus for deeper heating for which effect he suggested the name "diathermy".

The frequency of a diathermic current is considered to be approximately 1,000,000 oscillations per second and to be propagated with the speed of light, 300 million metres per second. If it is desired to express such a current in terms of linear measurement we divide its rate of propagation by its frequency and so obtain a wave-length of 300 metres.

Short-wave diathermy.—By a further development of electrical apparatus employing the electronic tube or valve, the modified spark-gap and the perfection of oscillatory circuits of high magnitude, the short-wave or ultra-short-wave apparatus has been made possible, with the production of electromagnetic oscillations of between 10 and 100 million cycles per second or, in terms of linear measurement, with the production of wave-lengths of between thirty and three metres. According to Kobak [1] the term "short" or "ultra-short" wave is meaningless, as these waves are of a quasi-optical variety—being long waves in relation to the infra-red, and short, or ultra-short, only in contrast to the longer high-frequency waves of diathermy. Just as the term diathermy has universally become the designation of a definite range of high frequency, Kobak has suggested that the term "radiathermy" might be acceptable for the range of ultra-high frequency located between diathermy and infra-red. Further, diathermy currents achieve their object by conduction, those from short-wave—or radiathermic—apparatus, by polarization effects in the tissues.

In the production of suitable currents for radiathermy it is suggested that the important feature for all apparatus is high output or wattage.

Electromagnetic induction.—More recently electromagnetically induced currents of approximately 30 metres have been introduced into therapy. This so-called "inductothermy" differs from radiathermy in that it induces by electromagnetic waves eddy-current heating in the tissues. Living material within such an induction field becomes heated from superficial to deeper parts by the less insulated pathways of the vascular tissues, adipose and osseous tissues being affected to a lesser degree. It appears to be valuable for deep heating effects and to be of use in the production of artificial fever. The induction is applied by coils laid on the part or contained in specially constructed discs.

Therapeutic uses of ultra-short-wave currents in laryngology.—It is possible, by arrangement of the condenser plates of a radiathermy machine of high wattage, to obtain both superficial and deep heating effects.

In the results of treatment of 100 ear, nose, and throat cases by ultra-short-wave therapy published by Alexander Laszlo [2] we have an example of its application in laryngology. The majority of these were cases of sinus infections; others of interest to us in this discussion were cases of nasal furuncle and peritonsillar abscess. In the majority of the cases spark-gap machines were used, with changeable wave-lengths (mostly six metre) with 150-watt output. In the remaining cases a machine with a fixed spark-gap (giving 9½-metre wave-length) with 150-watt output and also a tube machine (6 metre) with 400-watt output. Electrodes were applied to the head over felt pads and towels or, in other cases, with glass and air spaces between themselves and the part under treatment.

The acute cases received most benefit—pain disappearing with amelioration of clinical symptoms. Acute and subacute purulent ethmoiditis with pain reacted well, a few of them being fulminating cases, some in children with or without external

[1] *Arch. Phys. Therap.*, 1937, **18**, 396.
[2] *Ann. Otol., Rhinol., and Laryngol.*, 1937, **46**, 174.

œdema. The pain disappeared entirely after a few treatments and orbital œdema subsided, but discharge still remained and some of the adults had to undergo surgical treatment. In contrast, cases of chronic ethmoiditis with hyperplastic changes received no benefit whatsoever. Cases of sphenoid infections with post-nasal drip and headaches received benefit only in so far as the headache was concerned. Cases of acute frontal sinusitis also received cocaine-adrenaline tampon applications in the middle meatus, and they were advised to rest and to apply heat over the sinus at home.

The difficulty in assessing the value of treatment lies in the fact that the majority of these cases react well without the short-wave therapy under similar circumstances. Laszlo found that cases of nasal and upper lip furunculosis—in which surgical intervention should be avoided, if possible—could be effectively treated by this form of therapy, and that peritonsillitis in the early stage usually disappeared after one treatment by short-wave therapy, while in the more advanced cases pain was diminished and pointing hastened. The disappearance of the pain allowed the patient to take nourishment more easily and the characteristic rigor was diminished.

The use of electro-coagulation in non-specific chronic tonsillitis.—I have had no experience of electro-dissection of the palatine tonsil or of its complete destruction by more energetic coagulation, but I have tried conservative fractional coagulation with a small electrode. Secondary hæmorrhage, however, is not unknown even after this treatment. The method has been a useful compromise in a few selected cases. Hollender says of this—

> "It has long been appreciated that one or two electro-surgical treatments to each tonsil promptly relieve the discomfort suffered by patients with rheumatoid conditions",

and he quotes Silver's conclusions :—

> "The general reaction simulates the response to inoculation of an autogenous vaccine made with a virulent organism. It is apparently specific. The occurrence of the relief from distal bodily pain and stiffness is independent of the total sterilization of the tonsils."

Such ideas recall one of the more recent views about the physiology of the palatine tonsil—expressed by Thorsten Skoogh [3]—that the pharyngeal lymphoid tissue, of which the tonsil is only a part, sensitizes the other parts of the reticulo-endothelial system (spleen, bone-marrow, lymphatic system) to more energetic reaction to infection.

Phototherapy : Ultra-violet irradiation.—In discussing the use of phototherapy of this kind I shall refer to general irradiation only. The majority of laryngologists will be concerned as to when it should be advised rather than in directing its actual technique. Not only the ultra-violet rays, particularly those between 290 and 313 M.U. are responsible for the beneficial biological effects ; the luminous and infra-red rays, if not specific in their action, aid the ultra-violet rays. We should, therefore, choose a source of energy having such qualities. Sunlight appears to yield ultra-violet 1–5%, luminous 41–45%, and infra-red 52–60%.

The air-cooled quartz mercury-vapour lamp provides ultra-violet rays, 28%, luminous rays, 20%, and infra-red rays, 52%. It is strong in ultra-violet and gives some far ultra-violet rays not found in sunlight, namely shorter than 290 M.U., but its spectrum is not continuous as is that provided by sunlight. The white-flame carbon-arc lamp having carbons impregnated with so-called rare earths and fitted with a special (Corex D) glass screen, is not so convenient to work as the mercury-vapour lamp, but provides irradiation very near to sunlight, 5% ultra-violet, 62% luminous, 33% infra-red.

It would be a practical question to ask whether an amount of artificial sunlight equivalent to that received from the sun's rays by the neck, face, hands, and wrists, in ordinary clothing in summer, would be a useful aid to general dietetic and tonic treat-

[3] *Acta Oto-Laryngol.*, 1935, **23**, 63.

ment in upper respiratory tract infections in winter time. Smiley found that under treatment of this kind the incidence of the common cold in susceptible subjects was lessened by about 40% against controlled susceptibles.

The child when entering school is, as we know, heavily bombarded by infection by his fellows, and if he is susceptible he suffers from colds in the head, passing sinusitis, acute pharyngitis, and tonsillitis. Dr. Howel Evans informs me that if the blood of such children is examined a certain degree of unsuspected anæmia is constantly found and he suggests that iron therapy, with vitamin A, in addition to heliotherapy, will minimize the incidence of these infections.

W. A. Troup said that during the last nine months he had treated 20 patients who had had two or more operations for the relief of chronic sinusitis. One had had 18 such operations and another had had 30, while several had had four or five. Every one of them had given up hope of obtaining relief. Infra-red irradiation had almost invariably relieved the pain from which these patients suffered.

He had proved in innumerable cases that this method would establish drainage and produce a deep-seated hyperæmia of long duration. Patients who could not be helped by such measures were few. The results of treatment were acceleration of the blood and lymph-flow to the affected sinus, decongestion of the ostia, improvement of drainage, relief of headache and neuralgic pain, and a bactericidal action on infected mucous membranes. A diet rich in vitamin B should be ordered and a preparation of vitamin B prescribed.

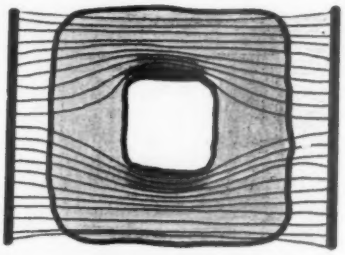
P. Bauwens said that the particular therapeutic agent to which his remarks would be confined was short-wave therapy. In spite of the implication of this term, this form of treatment was not a radiation therapy in the sense of X-rays, ultra-violet rays, or infra-red therapy. A better name would be ultra-high-frequency therapy, as it was in reality a method whereby the tissues were introduced in an electrical field alternating at very high frequency (of the order of 50–100 million times per second).

Electrical energy oscillating at such frequencies had properties which were not in evidence at lower frequencies, as it could be transmitted across space by what was termed displacement. Whereas in the case of diathermy the electrodes had to be in contact with the patients, this was not necessary in short-wave treatment. The layer of air which separated electrode from tissue transmitted the energy by virtue of its dielectric properties. It must not be concluded that this form of energy invariably chose such a method of propagation. It only did so when alternative paths, if present, offered a greater impedance.

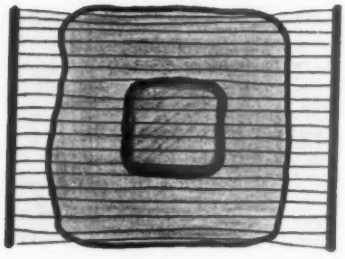
In illustration he showed a figure on the epidiascope representing a piece of tissue with a cavity in its centre (*see* fig. 1). If this was introduced in a short-wave field, although the energy was transmitted across the space between the electrode and tissues because of the absence of alternatives, this was not the case with the cavity. Here the energy adopted the path of less impedance through the tissues. Another figure showed the importance of treating aerated cavities by cross firing if the walls of the cavity were to be subjected to the field (fig. 2), and yet another showed the difference in the distribution of the field intensities when an object of a laminated nature was rotated through a right angle (fig. 3). He drew attention to the way in which points of contact in the one case caused concentration of the field.

The human skull with its aerated sinuses was comparable to a hollow organ. The sinuses might be aerated or full of fluid or again reduced to a mere potential space by the thickening of the mucosa, and it was important to have skiagrams of the skull at hand before deciding what technique to adopt in each individual case.

[Dr. Bauwens showed photographs illustrating the various methods of treating sinuses in ultra-high-frequency fields as developed at St. Thomas's Hospital (*see* figs. 4, 5, and 6). He also showed skiagrams, taken before and after treatment, from



(*a*)



(*b*)

FIG. 1.—Diagram showing the field distribution in a hollow organ introduced in an ultra-high-frequency field when the organ (*a*) is aerated (*b*) contains fluid.

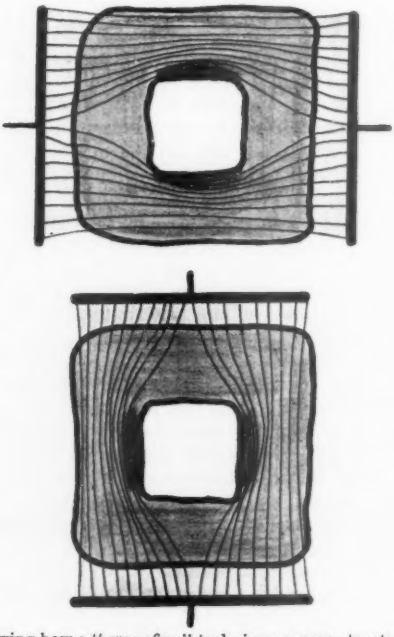


FIG. 2.—Diagram showing how a "cross-fire" technique ensures treatment throughout the aerated organ.

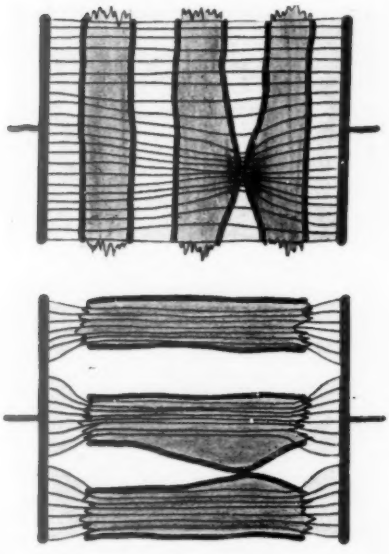


FIG. 3.—Diagram showing the different distribution of the field in laminated organs for two applications of the ultra-high-frequency field and how damage might occur through undue concentration under certain conditions.

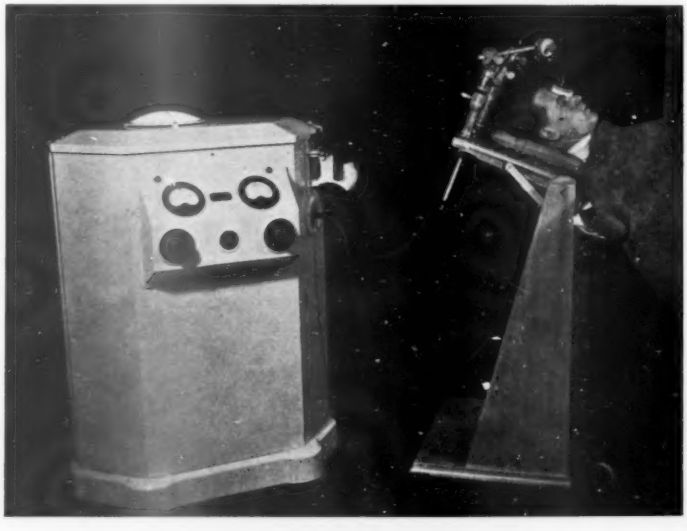


FIG. 4.—The ultra-high-frequency current generator, with the head table used for the treatment of a frontal sinus. The lead to the electrode under the table can be seen.

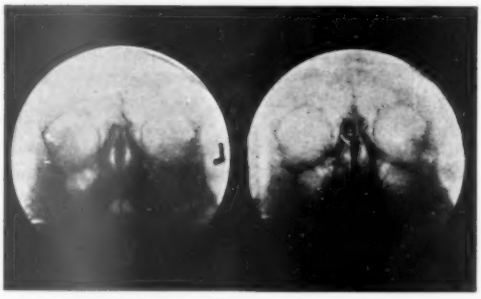
FIG. 5.

FIG. 6.

FIGS. 5 and 6.—Showing the application of short-wave therapy to the treatment of frontal and ethmoid sinuses. A modification of cross-firing technique is illustrated here.

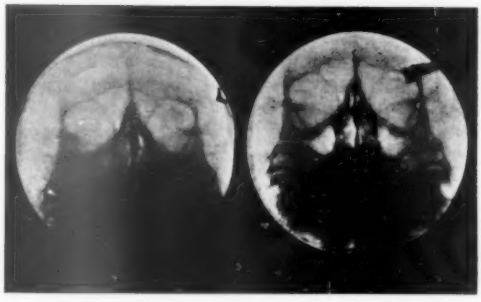
cases of children aged under 14 years, who were suffering from bronchitis or asthma associated with opacity of the maxillary antra (*see* figs. 7 and 8).]

He submitted these without comment, but desired to point out that he had seen conditions apparently in every way analogous to these, which had cleared up with



February 3, 1937. April 7, 1937.

FIG. 7.—J. T., 7½ years.



February 10, 1937. July 4, 1937.

FIG. 8.—V. D., 11 years.

ultra-violet ray therapy only. Most of his cases received multiple treatments. In many cases treated by short-wave and ultra-violet rays calculated to benefit the general condition, the symptoms disappeared and the antral opacity was diminished on X-ray examination.

A. Friel said that zinc electrolysis was of value in making an opening through the naso-antral wall in those cases of maxillary empyema in which a simple drainage operation through the nose was considered sufficient treatment. A puncture was made well back under the inferior turbinal, by a stout zinc or brass wire, or by a steel rod, the pointed end of which was coated with zinc. This formed the positive electrode, while the negative was placed on the arm. When the current was turned on, a ring of tissue around the wire was coagulated and destroyed. The extent of the ring depended on the strength and duration of the current. As the tissue was permeated with antiseptic zinc ions sepsis did not result. The treatment was carried

out under a local anæsthetic and it was not necessary for the patient to go into hospital or cease his work. No after-treatment was given. A contra-indication of this method was a thick naso-antral wall.

A. Eidinow (in reply) said that he had had the opportunity during the last three years of treating about 50 cases of toxic arthritis in which the tonsils had been suspected as the focus of infection, and he had tried to remove the tonsils by diathermy. All these cases clinically did well, but he was disappointed with the bacteriological results. He found the same types of streptococci prevalent after removing the tonsils as before.

H. V. Forster (in reply) said that it had still to be decided whether it was of real practical importance in heliotherapy to choose a light source as near as possible to sunlight, because the air-cooled mercury vapour lamp, which did not fulfil these requirements exactly, was nevertheless more convenient to use.

Section of Otology

President—F. J. CLEMINSON, M.Chir.

[*March* 4, 1938]

DISCUSSION ON LATERAL SINUS THROMBOSIS

Mr. Lionel Colledge: I have no reason to depart from any of the statements made in a paper read at Glasgow in 1922, but it is interesting to consider whether during the interval of fifteen years altered conditions or fresh methods suggest any modification of views or practice, the general pathology and principles of treatment being familiar to all of you.

In pathology we are accustomed to view the thrombosis as a protective mechanism, the danger of the disease lying in the infection of the wall of the vein and secondarily in the infection of the protective clot whereby a systemic blood infection and embolic dissemination of infective particles may take place.

The posthumous work of the late A. A. Gray entitled "The Basis of Tissue Evolution and Pathogenesis" leads to the conclusion that repair, as a result of injury, takes place not as a purposive act, but in accordance with the laws of natural selection. The process ultimately comes to have the appearance of a purposive act, but these qualities were not originally teleological in the sense of having been designed to protect the individual animal. It is impossible to pursue this subject further now, but I take the opportunity of commending to you this study in the philosophy of evolution by our dear friend Albert Gray.

It used to be a common question at the examination in surgery of the Royal College of Surgeons whether lateral sinus thrombosis arose more commonly as a complication of acute or of chronic suppurative otitis media. The correct answer was that chronic otitis media was more commonly responsible, and this certainly would be supported by clinical experience in otological practice at that time. Körner, in his book on the complications of aural suppuration, stated that the primary disease is more often chronic than acute. Thus in a collection of 583 cases 347 were caused by chronic otitis. I cannot find that Ballance expressed any view on this point, for he speaks of suppuration in the temporal bone as producing infection and thrombosis of the lateral sinus and appears to assume a chronic suppuration, which certainly it usually was, for he describes the radical mastoid operation as the first step in the operative treatment. I do not know what answer is expected now by the examiners at the Royal College of Surgeons, but the answer formerly expected is no longer correct. Behrmann, in 104 cases at Gothenburg, found acute otitis in 68, and I think this must now be the general experience. Mr. Pereira has collected some figures for me from St. George's Hospital. In the five years 1910–1914 acute otitis was responsible for 27% of the cases, in 1920–1924 for 60% of the cases, and in 1930–1934 for 71% of the cases.

The green sloughing sinus filled with decomposing clot secondary to a foul cholesteatoma in the temporal bone, a common picture twenty years ago, is now quite rare. Changes in the nature, virulence, and incidence of disease are not infrequent. Chlorosis, ozœna, and scarlet fever, provide examples. In the case of sinus thrombosis a plausible explanation can be given easily. Compared with the conditions amongst all classes, and the hospital class of patient in particular, the incidence of chronic otorrhœa has enormously diminished, although it remains common enough. The removal of adenoids and other treatments prevent many cases of otorrhœa from becoming chronic, and chronic otorrhœa itself is treated by a mastoid operation or, if allowed to persist, is generally of a harmless variety without cholesteatoma or extensive bone disease. Those types of chronic suppuration likely to produce this complication are consequently less common, and therefore the proportion of cases associated with acute otitis is higher, the total incidence being naturally less.

The type of case arising from cholesteatoma and very chronic bone disease, in which thrombosis and sloughing of the lateral sinus, exposing suppurating clot, are the characteristics, is liable to produce pyæmia. More common now is the acute streptococcal otitis producing septicæmia, either by a thrombosis of the small venous channels in the temporal bone or in one of the larger sinuses. Pyæmia is occasionally caused thus, recent examples being a pyæmic abscess among the tendon sheaths on the back of the hand and another an abscess in the occipito-atlantal joint. Both patients were small boys, of whom the first recovered, but for the second, naturally, nothing effective could be done, and the abscess was found at autopsy.

It has, however, been shown post mortem that a primary thrombosis in the dome of the jugular bulb from an infection passing through the floor of the middle ear may occur. I believe that some of those cases in children in which no thrombosis is found in the lateral sinus on incision, but in which recovery takes place after ligature of the jugular, represent this form of venous infection though proof is not possible.

In the cases of double otitis in which it is of vital necessity to discover upon which side the venous infection has originated and the appearance of the exposed sinus gives no indication, the method which Dr. Frenckner described here might be tried, but it is apparently open to fallacies. I have found that the usual test performed by noting the effect of alternate compression of either jugular vein upon the flow of cerebrospinal fluid after lumbar puncture can give a clear indication of the patency or obliteration of the lateral sinus.

The problems of treatment are now usually those of controlling an acute septicæmia rather than pyæmia. Where the septicæmia arises from thrombosis of small veins, operative treatment – beyond a complete removal of the primary focus of infection in the bone—can scarcely be effective.

I believe that the appeal to statistics upon the question of ligature of the jugular vein is valueless, and I have no sympathy with either ligaturists or anti-ligaturists. The indications for ligature were established by Ballance years ago. I have quoted them before, but I give them again now—

"The view that operation on the vein is never required, and the view that operation on the vein is always required, are equally erroneous. It is as absurd to tie the vein for a local abscess, which should be dealt with in the sinus region as in other parts of the body by simple evacuation, as it is to decry all operations on the vein, when it may contain a spreading infective clot which has been known to reach the heart.

Operation on the vein should be undertaken (*a*) in acute pyæmia and septicæmia, whether the sinus is occupied by clot or by fluid blood; (*b*) if the sinus wall is gangrenous, or its contents are putrefying, unless it is perfectly clear that on both sides of the area of inflammation the sinus is completely blocked by non-infected thrombi (how seldom this qualification will be operative must be obvious to all who have had any considerable experience of these cases); (*c*) if it is proved or even suspected that the blood in the jugular bulb is in part or wholly clotted; and (*d*) if the jugular vein is thrombosed."

Of my own cases only two in which the vein was not ligatured have been fatal and for many years there was no fatal case at all in which the vein was not ligatured, but that does not prove that ligature is not beneficial, and the dramatic result which frequently follows proves its value in properly selected cases.

Neither do I believe that operations on the bulb, of the type devised by Grunert, are ever required if the operation on the vein in the neck is correctly performed. I quote Ballance again on the guiding principles: "The vein should be tied in two places and divided between the ligatures so that the upper septic portion of the jugular vein may be completely isolated from the lower which remains an integral portion of the vascular mechanism." The best way of accomplishing this is by the method which is usually attributed to Alexander. The common facial vein is divided between two ligatures to prevent septic thrombosis ascending by that route, and the upper end of the jugular is brought out of the upper corner of the incision in the neck. The ligature on the vein can be removed the next day, and this is a more rational manner of draining the bulb than by a direct attack, which the patient is always in poor

condition to support. Before leaving this question it is timely to remind you that this year is the jubilee of this method of surgical treatment, for it is just fifty years since Lane first performed ligature of the jugular for this purpose, the first operation by Ballance being dated one year later.

At present the chief concern is to prevent the occurrence of septicæmia in cases of acute otitis, or to treat it in its initial stages, for there is now more opportunity of seeing patients with the disease early in its course and of keeping them under regular observation. In this respect the administration of prontosil has produced a revolution both in prognosis and treatment. [Mr. Colledge showed two charts from cases in which the onset of septicæmia appeared clinically to be clearly indicated, in spite of the mastoid operation—in one case double.] The charts show the response to the influence of the drug, but it is impossible to say for certain whether thrombosis had occurred. This seems to be the favourable moment for the administration of prontosil.

In obstetric surgery it has been found, as might be expected, that where there is already an infective thrombophlebitis with suppurating clot in the veins, too much must not be expected even of prontosil. In the same way in the administration of the drug in aural surgery, if a suppurating clot is already present prontosil cannot be expected to work its charm without the aid of the appropriate surgical treatment.

[In conclusion the speaker showed a chart from a case of aural septicæmia which occurred before prontosil was available.]

The patient, a child aged 5, the daughter of a friend, was seen at the onset of the disease, but a double mastoid operation, ligature of the jugular vein on the most severely infected side, the administration of antiscarlatinal serum, and repeated blood transfusion, failed to control the course of the septicæmia. Streptococci could be cultivated from the blood in less than eighteen hours. It was possible, however, to obtain from France a drug in the form combined with red dye under the name of rubiazol, and the chart shows the response to this when all other treatment had failed. It is important to note that when the administration of the drug was stopped the temperature began to rise and it had to be exhibited again, but it is equally important, I think, not to prolong the administration unnecessarily on account of its possibly toxic effect. Although prontosil has rapidly become the main defensive weapon, small blood transfusions are an important supporting agent in treatment. The infection is always hæmolytic and repeated estimations of hæmoglobin and red cell counts are of great value. My own rule is to give small blood transfusions if the hæmoglobin falls below 60% ; the level might perhaps be placed slightly higher. A fall to 40% renders blood transfusion imperative.

I only wish to introduce the discussion and have not attempted any complete review of the subject and purposely left many points untouched ; I have selected merely a few given in the abstract, with the view of stimulating discussion on some of those that are most debatable.

Dr. D. A. Crow (Brighton) : When I accepted the invitation to read a paper on lateral sinus thrombosis I was pretty confident that I should have adequate material in my records from which to quote. I became less confident as I examined the records in detail, for I discovered to my surprise that of the total of 800 mastoid operations which I have performed, the lateral sinus was assumed to be thrombosed in only 11 cases. That gives an incidence of only 1·3%, comparing with the 4% which I find to be the average of all the figures quoted in the literature of the last twenty years.

I am prepared to believe that I work with singularly enlightened colleagues who do not allow cases of ear trouble with persistent pain to go unattended, and this increasing tendency to treat ear cases with respect leads me to suppose that by the time we have arrived at a conclusion as to the best way of treating lateral sinus thrombosis, there will not be any lateral sinus thrombosis to treat.

Much as I deplore hasty operations on the mastoid—I never dream of opening a mastoid under ten days from the onset of ear trouble—I consider that it is equally

deplorable to allow a lateral sinus to become diseased through neglect of the symptom of pain, which always, in my experience, precedes such an event.

I have admitted a somewhat scanty record of cases from which to draw conclusions; there is no value, therefore, in stressing the low mortality of two deaths out of the 11 cases when the series is too small to allow of convincing deductions. However, I may mention, in passing, that the recorded mortality rate varies from 30% to 40%. And though I base my belief in conservative treatment to some extent on my own experience, I support it to a greater extent by reference to the experience of others and by broad considerations of anatomical and surgical common sense.

In one of my fatal cases bronchopneumonia developed three days after wide exposure of an infected and probably thrombosed lateral sinus, without ligation of the jugular vein or interference with the clot. Obviously, such an experience appears at first sight to weaken the case for conservative measures; it would do so still more, however, if radical measures were invariably attended by success. In actual experience this does not seem to be the case, for a 39% mortality was reported by Ballance in 1919 and that with the most heroic surgical interference, and a 33% mortality is recorded by Dill (1934) at the Johns Hopkins Hospital where only six out of the 30 cases did not have ligation of the jugular. The fatal case to which I have referred occurred a few weeks after a severe case of thrombosis, in a boy aged 12, in which rigors followed a week after ligation of the jugular—an event which must necessarily shake one's faith in the efficacy of such procedure. On the other hand I have records of three cases of non-ligation with positive blood culture in which the pyæmia has subsided completely after two or three rigors—in one case, it is true, with metastases in the hip-joint.

The other fatal case I encountered a month ago: A man aged 35 with a twenty-year history of otorrhœa was found to have a massive cholesteatoma which had laid bare an inch of facial nerve but had not directly attacked the lateral sinus; there was swelling beneath the ear and pus was obtained on exploration of the muscles below the mastoid tip.

I took this to be due to an abscess from a suppurating gland. At post-mortem examination it was found that the sinus, right up to the torcular and down to below the jugular bulb, was a sealed abscess cavity. It would have been better in such a case to have resected some sinus wall, but to all appearances the part of the sinus deliberately exposed under healthy bone was normal.

Turning to the experience of others, one finds that so great a master of surgery as Macewen declined to interfere with the jugular; that Mygind (1931) records 71% of recoveries in a series of cases treated conservatively against 50% recoveries in a previous series treated radically; that Meltzer (1935) in America found metastases in 78% of cases after ligation and in only 21% before. From such, and many other recorded experiences, one may justifiably doubt the wisdom of too-vigorous surgery.

The argument for conservatism seems to me as follows: Metastasis occurs after ligation with surprising frequency (some say more often). This is due either to thrombosis in a collateral, or to "seeding" from an existing metastasis—in neither instance prevented by ligation. We are not dealing with detachment of large clots such as the pelvic clot of the puerperium; we are considering minute fragmentation and a pyæmia set up by escape into the circulation of perhaps only a few organisms. This can occur just as well from the petrosal or other collaterals as from the jugular bulb, and might conceivably occur more readily if the clot in the sigmoid sinus were disturbed.

How else do we explain the almost constant experience of a continuation of rigors after ligation and removal of clot? In almost every paper one reads on the subject this picture occurs.

The clot is obviously a protective mechanism and if the surrounding necrosis is removed and the loose packing absolutely undisturbed for seven days, I for one have confidence that the clot is more protective than an extra surgical operation for its removal, at a time when the patient has little enough reserve defensive mechanism.

The picture has also been vastly changed by the advent of prontosil. (I make no hesitation about calling the drug by its original name as I think the credit should go where it has been earned.) In prontosil we have a drug which in the experience of us all can cope successfully with the direst streptococcal meningeal infection, and more readily still with the type of pyæmia which we are now discussing. There has always been doubt as to the wisdom of ligation and turning out of the sigmoid clot; it seems to me that prontosil has weighted the balance quite heavily in favour of conservative measures. I feel, therefore, that the anxious decisions as to whether the clot is to be removed, and the jugular ligated, can be dismissed as stepping stones to our present much less troubled position.

I shall myself feel no doubt that in future the best interests of the patient will be served by a rapid excision of the bone round a diseased sinus (and the whole operation need seldom take more than fifteen minutes), a gentle gauze pack absolutely untouched for seven or ten days, a far greater insistence on complete immobility of the head and neck, and finally the administration of prontosil in the type of case likely to respond to it.

The only exception to this conservative principle is the rare type of case such as I have quoted—in which there is reason to believe that the sinus has been transformed into a closed abscess cavity. This type of case I regard as more likely in chronic ear disease, and if I again find evidence of jugular phlebitis, associated with a temperature which the cholesteatoma does not appear to explain, even though the sinus may appear normal, I shall excise a portion of the sinus wall but on no account actively disturb its contents.

It may be argued that any doubtful sinus should be incised, but I do not agree, for such interference will more often infect the non-infected blood-stream than it will discover a frank abscess which needs draining, and if a clot is doing its best to shut off a septic area from the circulation I am all for leaving it alone. Moreover, there may be no clot found at the time of incision, yet one will form as a result of the subsequent pack.

I am not so eager a surgeon as to believe that the only way of advancing surgery is to make it more complicated, but, on the other hand, I am not so prejudiced as to reject any evidence which may be brought forward to prove that I am over-simplifying the problem.

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Mr. T. B. Layton: I want to speak briefly on the symptomatology of this condition. Most of my experience comes from cases in which there is an acute inflammation of the previously uninfected middle-ear cleft, and unless I specially refer to some other conditions I want it to be assumed that I am speaking about that type of case, and that I look upon the clot as Nature's protection against the invasion of the blood-stream.

In those circumstances there are three anatomical conditions that may arise. The first is thrombosis of the sinus, without the thrombus itself being infected by hæmolytic streptococci; the second is the infection of the thrombus itself, breaking down ultimately into pus; the third is the condition in which there is a thrombophlebitis with a clot within and some visible inflammatory change in the vessel wall. I should like to speak on each condition separately.

I do not believe that there is any symptom whatever of the formation of a clot within the lateral sinus. The symptoms usually described as such are symptoms of the invasion of the erythron by the hæmolytic streptococcus. They are usually described as rigors. I want to suggest that there is no absolute dividing line between the sudden rise of temperature and the completely developed rigor. At 2 o'clock in the afternoon the patient's temperature may be normal or subnormal, but taken at 5.30 p.m. it is 104° F. I used to think that it always rose at 5.30 p.m. until I had

some cases in the summer when it rose at the same hour, although in the meantime the Government had changed the clock. If we made an investigation by taking the temperature every quarter of an hour we might find that the jump of temperature was not quite so sudden as we have usually thought, and that it is going up rapidly over a sequence of several hours. The next stage is where the patient feels a few subjective symptoms associated with the rise of temperature. On one occasion in a middle-aged man who had large vessels in the skin of the face I observed a transient cyanotic suffusion of the veins of the face, and the temperature had gone up. The patient, in reply to our questions, said that he did not feel cold, but felt a little uncomfortable. In the next stage the patient definitely feels cold, and later he not only feels cold, but we can observe the shaking of the muscles. Finally, we get the complete stage with all these symptoms and the breaking-out of beads of sweat upon the skin. I do not believe that there is any dividing line between one end and the other. All the symptoms are evidence of the access to the blood-stream of the hæmolytic streptococcus.

That, to my mind, is the time when we should remove the factory of organisms that is in contact with the dura mater. I do not think we should do anything more, unless there are obvious changes in the walls of the dura mater which suggest that the infection must be in the vein internally. After that the patient either gets well or does badly, and again I believe that the symptoms recur about forty-eight hours after the original operation and tend to occur in the evening at the time when normally the body temperature is likely to rise.

If the symptoms recur we should then suspect that the factory of organisms is in the clot in the lateral sinus. At that stage I open the lateral sinus. As a result of some remarks made at a meeting of this Section by Mr. Sydney Scott I now take out a piece of the sinus wall. In the first of the two cases which I showed to-day I sewed it back as a flap, but that is totally unnecessary. When that has been done, suspecting that the clot is infected, I should remove the clot. I believe that theoretically the right thing to do is to remove the abnormal clot and to stop on reaching good healthy purple clot at either end, but I admit that it is very seldom one is able to do that, and I do not think it is necessary. I have done it once in a very serious case, and I suspect that avoidance of additional loss of blood in that case—a small child—may have saved its life. Usually the amount of blood lost is not harmful to the patient.

I lay great stress at this stage on making sure that one gets the bleeding from the torcular end. I find it difficult to go back, supposing one has to operate again, and remove more bone at a subsequent operation, but one can always tackle the blood-stream afresh in the neck.

If after another forty-eight hours the patient is still doing badly, we have the problem before us as to whether it is the organisms already in the blood-stream that are continuing to cause the symptoms or whether there is still a factory of organisms from which access to the blood-stream is still occurring. Anatomically that factory of organisms may come from the upper part of the jugular vein, and there we have to decide whether we should ligature, and if so, whether we should in addition open the vein. I have not time to go into details, but I totally disagree with Mr. Colledge's contention that one must do the somewhat heroic operation carried out by Lane and Ballance. I have never claimed to have fingers in any way to compare with those of Lane, and I look upon the bringing out of the upper end of the divided jugular vein and sewing it into the neck as an extremely difficult operation, and I believe there are many other efficient surgeons who would find it extremely difficult. Further, I do not believe it is necessary, and again I think that when one is dealing with that infected vein the less one disturbs the cellular tissues of the neck the better.

Sometimes a swelling of the sinus wall is associated with thrombosis. We then have a thrombophlebitis. I suspect that this is a bacteriological problem. It may be that the hæmolytic streptococcus kills the patient before the changes in the vessel

wall have occurred. In the cases I have seen the symptomatology has been quite different, being very vague and indeterminate, and the thrombosis and the phlebitis have spread extensively. I remember one case in which the Klebs-Loeffler bacillus was discovered from a clot not only in the sinus but also on the surface of the brain. I suggest that these cases may be commoner in chronic ear disease, and that they come under a different category from those which the majority of us see in acute disease.

If these views are correct then it is not the thrombus that matters. We have got to consider its removal on clinical grounds. We cannot tell whether there is a thrombus in the sinus until we have slit it up, and seen whether it is there. We should talk less about thrombosis of the sinus and more about invasion of the blood-stream and should determine where the factory of organisms is from which the blood-stream is being invaded.

There are, however, certain conditions in which the clot, not being infected, extends; I suggest that there are three directions in which it may do so. One is down into the jugular vein. That is where we get the symptoms of jugular thrombosis in the neck, and we ligature in order to prevent extension to the heart. Again, extension may take place backwards to the torcular, and then around the corner, either into the superior longitudinal sinus, or into the straight sinus. Those are the cases which come into the neurologist's hands and on which Dr. Symonds has recently written an important paper in *Brain* [1], in which also he has quoted other work [2] on the subject. There is a third way in which the thrombosis may extend, and that is by the veins that pass into the sinus from the surface of the cerebrum. I suspect that it is the thrombosis spreading along those veins which may finally explain the symptomatology of certain cerebral conditions that occur in ear disease. I also suspect that when the thrombus is infected it may be the clue to the way in which infections spread from the ear to the brain or the cerebellum without giving rise intermediately to a meningitis.

REFERENCES

1 Symonds, *Brain*, 1937, **60**, 532.
2 Courville, C. B., and Nielsen, J. M., *Arch. Oto-laryng.*, 1934, **19**, 451; *Am. J. Dis. Child.*, 1935, **49**, 1.

Mr. Holt Diggle said he had been interested when he searched through his records for the last eighteen years or so to find, as Dr. Crow had done, that very few cases of lateral sinus thrombosis had come to light. He could only speak of a very small number—13. Out of those 13 cases there had been recovery in nine. They represented cases both from hospital and from private work. The mortality therefore was in general agreement with that mentioned by Dr. Crow, namely, about 30%. It was undoubtedly true, as had been already pointed out, that the incidence was falling. The larger number of his cases had occurred within the first ten years of the period taken, and in more recent years there had been very few.

Another interesting point which was often overlooked was that it was not so much the thrombosis which killed, as the very frequently associated and dreaded meningitis. It was surprising how often in the very late stages a severe meningitis was associated with a thrombosis. He mentioned this because, of the four deaths in his series, meningitis was responsible for three.

With regard to treatment: There could be no doubt of the value of early diagnosis. Such a diagnosis could only be made by actually exposing the lateral sinus. He would therefore urge that in all cases where there was any reason to suspect that the sinus wall was invaded, by reason of symptoms such as rigors, or a rising temperature, there was no harm whatsoever in exposing the sinus wall. If it looked healthy, and particularly if it felt healthy—because feeling was of more value than looking in these cases—he would certainly leave the sinus alone, but if it felt at all cordlike, he would have no hesitation in slitting it up. There was no harm in needling a sinus, provided that in needling the precautions of strict asepsis were observed. In quite a number of cases he had carried out very fine needling and aspirated when pure blood had been so aspirated, and no untoward effects had followed.

Most of the textbooks advised thorough exposure of the mastoid by the radical operation. He (the speaker) thought that was a great waste of time in the case of a person seriously ill. He himself performed a simple Schwartze operation, the radical operation being completed later if required. This was the method which had been carried out in all his cases.

He was very much opposed to the dictum that the internal jugular vein should never be tied, because that would mean losing a very valuable surgical procedure. Actually the jugular was tied in eight of his nine recovered cases but—on the debit side—it was also tied in three of the four cases in which the patients died. His indications for tying it were the persistence of temperature and rigors, and if there was no bleeding from the lower end. He did not tie the vein in continuity; he tied it in two places and divided between.

Owing to the advent of drugs like prontosil, the seriousness of thrombosis would undoubtedly diminish in the future. Many of the cases which he had described belonged to the earlier days when such a valuable drug as prontosil was not available. He had recently had two cases of cavernous sinus thrombosis associated with nasal suppuration. It was obvious that there was no vein which could be ligatured but both cases had responded very quickly to treatment by prontosil.

The President said that he had been pleased to hear Mr. Colledge mention the posthumous work by their much-mourned colleague Alfred Gray. This work was published at the end of 1937 and represented a good deal of thought spread over many years. In it the author speculated on the subject of evolution and on the part which the repair of tissues might play therein. The book was one of great interest and one which would make its readers think.

It was interesting also to be reminded of the great foundation stones in the surgery of the temporal bone which were laid by their distinguished ex-President, the late Charles Ballance. They stood to-day as firmly as during his lifetime.

He (the President) recalled an interesting case of a boy who had undergone an operation on account of acute otitis media. Later, rigors had developed, though the lateral sinus was exposed and was perfectly normal. In consultation with Mr. Wilfrid Trotter it was decided to tie the vein and this was done but none of the tributary veins was interfered with. The rigors ceased from that moment but the lateral sinus remained perfectly normal. About a week later it became solid and firm, but there was no other change. Soon in the exposed part an area of softening was felt which spread until it was about half an inch in length. Without even a local anæsthetic, he opened this soft area and found pus. He packed the cavity in the solid clot lightly with gauze, and everything cleared up without further trouble. That case was of interest as showing how insensitive the lateral sinus was. The only explanation he could give of the case was that the original thrombus was in the jugular bulb or one of the tributary veins and had spread later into the sinus. The entry of the infected material into the blood-stream had been stopped by the ligature of the jugular vein.

Mr. Douglas Guthrie said that Dr. Crow had raised some interesting questions in his advocacy of conservatism. At a meeting of the Section five years ago he (Mr. Guthrie) had ventured to say that there was an optimum time for operation in mastoiditis, and that that optimum time was not always the early stage. He had been severely taken to task on that occasion, but since then conservatism in otology had extended still further, and now Dr. Crow had stated that not only did he never operate in a case of acute mastoiditis under ten days after the onset of the otitis, but that he also applied a conservative attitude to cases of lateral sinus thrombosis.

Did Dr. Crow apply his conservative method, with regard to the exploration—as well as to the ligature—of the jugular vein? Did his conservatism apply to incision of the vein and removal of the clot?

It was not always easy to make up one's mind what to do after the vein had been exposed. Of course, in some cases there was no vein present at all, simply a sloughing mass, and naturally in that case one would remove the necrosed tissue. Furthermore, the correct procedure would be to leave the end clots, which were protective, but what to do on exposure of a vein whose wall had the appearance of red velvet was another matter. Was one to incise it or to leave it ? Personally he thought it should be exposed widely and then left alone. The sinus was extraordinarily insensitive, and one might later, even without an anæsthetic, or with a little anæsthetic in the case of a very nervous patient, incise the vein, but incision was seldom necessary.

Spontaneous cure of sinus thrombosis, he believed, occurred more frequently than was commonly imagined. He had personally observed two cases—both in children. In one of these another surgeon had found the jugular vein full of clot, the clot extending so far down into the neck that he did not feel justified in entirely removing it. Therefore the clot was left, and the patient had done perfectly well. In the other case the clot had extended as far as the torcular, and he did not feel justified in going any further, but left it. In that case also the patient had done perfectly well. Apparently, therefore, spontaneous cure could occur, and it seemed as though the end thrombus might be actually protective. From his own experience he thought that Mr. Colledge was correct when he said that many cases of so-called aural septicæmia in children were probably cases of thrombosis of the jugular bulb, the infection having spread through the floor of the tympanum.

Mr. H. V. Forster said that when faced with the problem of otogenic sepsis he relied for guidance on the conservative policy adopted at the Commune Hospital in Copenhagen where the teaching of the late Holger Mygind and, more recently, that of S. H. Mygind, did not advise, in cases of lateral sinus thrombosis, the routine ligature of the jugular vein or the opening of the lateral sinus unless it was thought to contain pus. The primary focus of disease in the temporal bone was thoroughly eradicated and, though operations on the jugular bulb were not performed, the osteitis would be followed as far as the bulb if necessary. His own experience led him to favour this view. In one of his cases the tying of the jugular vein had appeared to stop the swinging temperature, but the onset of drowsiness had led to the discovery of a temporo-sphenoidal abscess, which had surprised him, until he discovered that this type of brain abscess associated with lateral sinus thrombosis was more common than the cerebellar type.

In cases of otogenic septicæmia or pyæmia in children he was less concerned than he used to be about the presence of an actual lateral sinus thrombosis, though it might be argued that a clot had formed in the dome of the bulb. He had read that in infants thrombi had been found post mortem in the small veins of the temporal bone, the lateral sinus remaining free from clot.

Mr. E. D. D. Davis said that when there was a perisinus abscess it was usually at the lower end, near the bulb, and a complete exposure of the sinus was necessary. All otologists were familiar with the appearance of a normal sinus when it had been exposed ; it ballooned into the wound, and when compressed by a plug at the top end, it collapsed. That was a fairly sure sign that it was not thrombosed. He had never been satisfied with the needling of a sinus.

With regard to indications for ligature of the vein : If there were a perisinus abscess and a swinging temperature and rigors, or if the bulb was suspected owing to the absence of bleeding, ligature was necessary. Occasionally, organisms were found in the blood, and in that case also ligature was necessary. Mr. Layton had shown two cases in which he had opened and plugged the sinuses. The patients apparently did well for forty-eight hours and then the temperature had gone up again. Mr. Layton ligatured the vein and both these cases then did well. He (Mr. Davis) had had five similar cases, all in children under 12, with the same swinging temperature after the

sinus had been opened and plugged. The subsequent ligature of the vein had been followed by a normal temperature. Mygind had recorded that in 71% of his cases in which he did not ligature the patients recovered. But 43% of these had pyæmic and metastatic symptoms and were more or less lucky to have recovered.

As to the site of the ligature of the vein, the late Dr. Dan McKenzie had said that the vein should be ligatured above the common facial. In cases of bulbar thrombosis that was the easiest way to drain the bulb. Dr. McKenzie did not approve of ligaturing the common facial vein, presumably because thrombosis of the jugular vein might occur below the ligature.

Mr. Sydney Scott said that it was not necessary to add anything to what Mr. Colledge had said with regard to the protective nature of the thrombus, because that had been brought out in the discussion.

With regard to changes in incidence of the condition, he presumed that Mr. Colledge was speaking of a period of several years. His own first case of lateral sinus thrombosis had come in with a diagnosis of typhoid fever; as the thrombus in the jugular vein extended down to the subclavian it was a hopeless case. He had seen 154 cases of lateral sinus thrombosis at St. Bartholomew's Hospital in about thirty-five years. Figures from the hospital statistics could not, however, be trusted absolutely. For instance the patient whom he had shown that morning (p. 53) had not, through some oversight, been included among these 154 cases, and he knew of others. So much depended on the nomenclature of operations and the compiler of records. Of these 154 patients, 54 had died, and the mortality therefore over a long period was fairly high—more than 30%. When the periods were divided he found that the pre-War mortality was 57·5%, whereas in some years since the War the mortality had dropped to 14%. Taking recent years: Ten years ago there had been 15 cases with six deaths; nine years ago, seven cases with one death; eight years ago, three cases with one death; during the last five and a half years there had been 19 cases with seven deaths, but many of these patients had died, not from septicæmia, but from associated meningitis.

These 154 cases had occurred in a total number of 4,738 cases of otitis media admitted to the hospital ear department in the course of thirty-three years, so that the incidence was definitely a low one.

With regard to the infection in thrombosis: Mr. Colledge had referred to streptococci. In a few cases other organisms had been found. He recalled one case of tuberculous thrombosis in a child, in which, during an operation, he had found the thrombus quite unexpectedly.[1] The patient, after many years, was still quite well.

Mr. Colledge had summed up Sir Charles Ballance's indications; experience confirmed their reliability. Diagnosis in bilateral cases was undoubtedly sometimes very difficult, and he need not refer to examples on this occasion. He agreed with Mr. Colledge's advice about ligature. With regard to blood examination: The patient whom he had just shown had been operated on in the absence of any pathognomonic symptoms because the pathologist had found streptococci in the blood. The lateral sinus had looked perfectly normal when exposed, but the mastoid emissary vein was evidently thrombosed, and when followed up led to the thrombus in the externally normal-looking sigmoid sinus.

Referring to the treatment of septicæmia associated with sinus thrombosis, by means of prontosil and similar drugs, he was rather surprised that so many expected prontosil to do all that was hoped for it. After all patients had recovered who had had nothing but water and glucose—no serum or anything else. Caution was necessary with regard to new drugs even while their potency was admitted. Recently he had had a case of streptococcal meningitis, from which the patient appeared to have recovered after the use of prontosil, to die later from anuria and uræmia without evidence of septicæmia or infective nephritis.

[1] *Proceedings*, 1916, **9** (Otol. Sect., 84).

Mr. Cowper Tamplin said that this was the day of preventive medicine, and he did not think it improper that surgeons should have some interest in the preventive aspect of lateral sinus thrombosis. Mr. Guthrie and Dr. Crow thought that in cases of mastoiditis it was better to operate late. Last year in his own hospital there had been 400 cases of mastoiditis and *no* case of lateral sinus thrombosis among them. The death-rate was 2·25%, and that included cases of meningitis brought in as such and deaths having nothing to do with the mastoid process at all, but included because a mastoid operation had been done. There had been only nine deaths in these 400 cases. All the nine were operated on *after* the eighth day. There had not been a single death in the cases which were operated on *before* the eighth day. Sometimes the operation took place on the first, second, or third day. In the previous year there were 360 cases of mastoiditis and among them one case of lateral sinus thrombosis, so that it might be said that in over 700 cases only one lateral sinus thrombosis had occurred. Did not this seem to justify early operation as at least one of the steps towards prevention ?

Mr. Leslie Powell said that, at a meeting of the Section some years ago, he had shown a case in which conservative treatment had been followed. The patient —a girl—finally had an abscess in the carotid sheath. He opened the carotid sheath, split up the vein, and put in a drainage tube. The patient recovered, but the following year she had lateral sinus thrombosis on the opposite side; she recovered from this also. The ligature had rather come into disrepute, but that was because it was used in the more severe cases, and therefore it figured conspicuously in the cases in which relief was not obtained. Rigors were not necessarily an indication for operation, nor was an actual septicæmia. He had seen a case in which there was a positive blood culture of streptococci in quite an early stage after a mastoid operation, but the patient had seemed perfectly well, and had made a good recovery without any further interference.

Mr. Ritchie Rodger said that apparently the diminished incidence of sinus thrombosis was due to the smaller number of cases connected with chronic mastoiditis —at least he gathered as much from Mr. Colledge's paper. That brought them back to the question of the prevention of chronic mastoiditis and of chronic ear disease. He had read a paper some years ago in which he laboured the point that chronic mastoiditis was invariably the result of unsuccessful treatment of the acute ear condition. Every chronic ear condition resulted from an acute one, and chronicity meant that the acute stage had been unsuccessfully treated. Their chief business was to teach their colleagues with whom they had any influence that these acute cases must be kept in hand until they had healed and were dry, failing which they must be subjected to operation. They must not on any account be allowed to lapse into the chronic state. They were encouraged to-day because the statistics brought forward furnished additional proof that the chronic ear was really becoming less common. Six or seven years ago he had published as a clinical note an interesting case of primary thrombosis of the mastoid emissary vein, without thrombosis of the sinus, but giving rise to all the signs of sinus thrombosis. He was able to expose the vein for about an inch of its tortuous course in the bone, and to excise that extent of the vein, and when he got the last piece of clot away there was a gush of blood, showing that the sinus itself was not thrombosed. Yet that case had all the signs of sinus thrombosis, including rigors.

Mr. M. Vlasto said that not the least important point that had emerged from the discussion had been Mr. Sydney Scott's reference to prontosil. Whatever might be the therapeutic virtues of prontosil (and Mr. Scott was not denying that there were some), there was little doubt in his (Mr. Vlasto's) mind that the almost indiscriminate use of prontosil was tending to replace sound clinical judgment and correct surgical procedure. He was attached to a hospital in the country, and he had every reason for believing that the mental attitude there was in line with that in other hospitals—where prontosil was being given almost as a routine for any middle-ear

infection, quite irrespective of the type of organism responsible for the infection. He would urge caution not only in its use but in drawing deductions in cases in which recovery took place after its use.

Mr. Colledge (in reply) said that Dr. Crow had inferred from the literature that ligature of the jugular vein was probably useless because it did not influence the percentage of recoveries. His (the speaker's) paper had been intended to show that the incidence and nature of the condition had changed and was probably still changing. He thought, therefore, that any conclusion to be drawn from statistics must be fallacious, and he must return to the primary consideration that a clot might heal by fibrosis, but that if the clot was suppurating it was impossible for the patient to recover without proper surgical procedure; whatever else was done an abscess must be evacuated. Spontaneous cure might occur, but it could not occur in a suppurating clot.

One point raised by Mr. Layton was against operating on the vein because the operation was difficult. He (Mr. Colledge) did not think that the difficulty of the operation should deter the surgeon if it was the right thing to do, and he was sure that the operation of dividing the vein and fixing the upper end in the wound so that that end could form a drainage tube, was far superior to simply tying it. He believed that the operation was the one that Lane originally advised and in Ballance's textbook there was an excellent illustration of the way in which to carry it out.

Mr. Tamplin had raised the question of prevention. To prevent sinus thrombosis occurring after a mastoid operation, care was required to avoid injuries of the sinus wall. He did not mean gross injuries in which the wall was torn open, but minor injuries which did not even cause bleeding. The late Mr. Hunter Tod had drawn attention to this, and had reported one or two cases, in 1920 or thereabouts. He (Mr. Colledge) had himself had two cases in which without doubt thrombosis had occurred owing to minor injuries to the sinus wall, damaging the endothelial lining. The signs of thrombosis began to occur about the tenth day after the operation. Mr. Tamplin advocated early operation and had rather implied that Mr. Guthrie operated too late. He did not think there was any question of operating too early or too late. Mr. Guthrie's object, like his own, was to operate at the right time.

Dr. Crow (in reply) said that he would not incise the vein at all unless he had reason to suppose that there was a frank abscess in the cavity—and he admitted the difficulty of deciding that matter—but, after all, most of these decisions were, in the last resort, instinctive. The question of the early operation in a mastoid case would open up too lengthy a discussion. He had never had cause to regret reasonable delay, but he had frequently had cause to regret having operated too early, because septicæmia could be so readily set up before the defensive mechanism was mobilized. In his experience, a ten days' delay had never meant the risk of lateral sinus thrombosis.

The question had been asked: "What symptom would indicate the onset of thrombosis?" One could never be absolutely certain that a thrombus was present, but if the conservative standpoint was adopted it did not matter so much whether there was a thrombus or not. If there was, obviously, pus in a sealed-up lateral sinus, he would certainly let it out, and his experience confirmed the truth of the two surgical principles: (1) "Where there is pus, let it out"; and (2) "where there isn't any pus, *don't* let it out"!

Mr. T. B. Layton (in reply) said that with regard to these cases of erythron invasion he maintained that what had got to be done was to stop the organism getting into the blood-stream. If invasion was still occurring one had to decide whether it was coming from the clot itself. He suggested to Mr. Scott that they had to distinguish between the infected thrombus and an abscess in the thrombus. The abscess in the thrombus must be very rare, but he thought there were a number of cases with infected thrombi and if, when one opened the sinus, instead of seeing the plum-coloured or purple thrombus, which was bulging, one saw a pallid, whitish, shrivelled-up thrombus, that was an infected thrombus, and sooner or later there would be invasion of the erythron if it were not removed.

With regard to the jugular vein two things were necessary. The first was to stop the blood from flowing through the jugular, in other words, to ligature. There were a large number of cases where the patient got well after a ligature had been placed around the jugular. It was quite likely that all would have been well without that ligature, and thus there was the old argument as between ligaturing the vein and not ligaturing. The second was to determine whether it was necessary to open the vein and remove the clot within it. If the clot within it was infected, and was acting as a factory of organisms it ought to be got out. What he had done in the two cases shown at the meeting had been carried out on the same principle as that followed by Lane fifty years ago, only it was simpler.

ILLUSTRATIVE CASES

Lateral Sinus Thrombosis and Septicæmia.—SYDNEY SCOTT, M.S.

Philip M., aged 34, admitted to St. Bartholomew's Hospital April 5, 1934, with recurrent otorrhœa (left) from which he had suffered since he was 8 years old. He often had attacks of pain in, and around, the left ear. The pain had been continuous for five weeks before admission, but it was doubtful if this was due to persistent otitis externa, which was masking the state of the middle ear.

The mastoid antrum was opened and drained. The temperature fluctuated between 99° and 104·2° F. Six days later hæmolytic streptococci were found in blood cultures. White blood cells only numbered 8,000 per c.mm.

The lateral sinus was opened; the clot was removed, and yielded a pure growth of hæmolytic streptococci. The cerebrospinal fluid was sterile, and contained no abnormal cells, but was low in chlorides.

Five days later pain in the left hip began, and acute suppurative arthritis developed in the left hip-joint, which was drained by Professor Gask. Pyrexia lasted nearly two weeks. The patient recovered with a fixed hip-joint, and has remained well since.

Scarlet Fever Complicated by Mastoiditis with Meningitis, and Sinus Thrombosis with Jugular Phlebitis.—T. B. LAYTON, D.S.O., M.S. (with the consent of the M.O.H., L.C.C.).

Maurice G., aged 6. Previous diseases—measles (uncomplicated).

7.8.34: Joyce Green Hospital. Onset of scarlet fever, typical in every respect, though the patient complained of earache at this time. Treated with intramuscular injection of 20 c.c. antiscarlatinal serum. The earache apparently ceased, as there was a further complaint of transitory pain in the ear four days later, by which time the rash had cleared, and the throat was normal.

16.8.34: A fairly marked serum reaction developed and cervical adenitis was reported. The temperature rose again, and in the course of the next four days the general condition appeared to become much worse. Adenitis became more marked, and serum sickness continued.

20.8.34: Temperature 105° F. Patient complained of pain in the region of the left ear. On examination, the throat was clear and no otorrhœa was present. Slight mastoid tenderness was reported the following day.

22.8.34: The patient was transferred to the South-Western Hospital. He was ill; temperature 102° F.; tongue furred. No otorrhœa. Left ear-drum congested, not bulging. Very tender over left mastoid process, and along course of internal jugular vein. Enlargement of left cervical chain of glands. No nystagmus present. Neck rigid. Kernig's sign not definite but suspected.

Operation.—Left conservative mastoidectomy. Extensive bone removal. Middle fossa dura exposed and sinus widely exposed—both looked unaffected. Douched with saline. Pinna stitched forward, wound packed with gauze.

Post-operative treatment.—Fluids ++++. Wound douched with saline at 110° F.—½ gal. t.d.s. Large loose gauze dressing.

23.8.34: Wound reported clean; very little blood-stained discharge. The following evening there was a sharp rise of temperature.

Operation (24.8.34).—Lateral sinus opened and clot removed. Packed with gauze. Free bleeding from upper end established.

Post-operative treatment.—Irrigations omitted.

26.8.34: Patient was not so well; the temperature had again suddenly risen to 104°F.

Operation.—Left internal jugular vein exposed in neck and tied. Common facial vein also ligated. Jugular opened and pale clot removed from it, but lotion did not pass down from above. Lower wound sutured. Upper wound lightly packed.

27.8.34: Dressings changed. Condition satisfactory. From this time the patient began to improve. The temperature rapidly fell to normal, but two subsequent rises gave anxiety for twenty-four hours each time. The mastoid wound remained clean and slowly filled up with healthy granulations. The neck wound continued to discharge, but both this and the discharge from the mastoid wound, were steadily clearing away until the patient developed tonsillitis (2.10.34). A few days later the mastoid wound was again pouring out pus, and otorrhœa was reported for the first time. However, the ear was dry and the wound healed within the next three weeks.

1.11.34: The general condition of the patient was good.

Scarlet Fever Complicated by Mastoiditis and Lateral Sinus Thrombosis.—T. B. LAYTON, D.S.O., M.S.

Doreen B. P., aged 5½ years.

24.9.35: Onset of scarlet fever. The case was not seen until the fourth day of the disease, when the acute stage of the fever had passed. Serum not given. Six days after admission (i.e. on the tenth day of the disease) a painless left otorrhœa developed. The ear discharge persisted in spite of treatment, though otherwise the patient made a rapid recovery and had been up and running about for a week when, one month after the onset of scarlet fever, pain developed in the left ear, the discharge became more profuse, and the temperature rose. The temperature remained at 100° F. though no other clinical evidences of mastoiditis were demonstrated.

31.10.35: Four days later the temperature rose suddenly to 103° F.

Report on examination: Otorrhœa less profuse. No mastoid tenderness. No neck rigidity. Kernig's sign negative. Abdominal reflexes present. Operation advised.

Operation.—Left conservative mastoidectomy. Extensive bone removal. Lateral sinus exposed. There was an extradural abscess and the sinus was covered with granulations. The pinna was stitched to the face, and the wound was lightly packed with gauze.

Laboratory report.—Bone from the mastoid gave a pure growth of hæmolytic streptococci.

Post-operative treatment.—Fluids ++++ by mouth. Saline douching to wound. Temperature continued to swing, though dressing appeared satisfactory.

5.11.35: Five days later further operation advised.

Operation.—Sinus further exposed—wall slit up and clot removed. Bleeding obtained from upper end. Wound packed with gauze. Temperature continued to swing for the following four days, and then fell to normal, though still oscillating through 1 or 2 degrees (97–99° F.).

11.11.35: Temperature suddenly shot up to 102·6° F. Patient complained of pain in left side of neck with inability to turn head to left.

Operation.—Kocher's incision on left side; internal jugular vein and common facial vein exposed, ligated, and divided. A probe passed up the proximal end of the jugular vein failed to show the presence of any infective material or clot. The proximal end of the vein was ligated and the upper part of the wound was loosely sutured. On the following day the condition was decidedly improved.

30 c.c. anti-scarlatinal serum and 10 c.c. polyvalent anti-streptococcal serum given. Temperature slowly subsided. The mastoid wound granulated well, and following early suppuration in the neck wound, this too cleared up, and within three weeks was healed. The mastoid wound was dry one week later.

1.1.36: Patient discharged in good general condition.

Section of Therapeutics and Pharmacology

President—J. W. TREVAN, M.B.

[*January* 11, 1938]

Nutritional Therapy during Pregnancy

By MARGARET BALFOUR, M.B., F.C.O.G.

THE scheme which is now being carried out by the National Birthday Trust Fund for improving the nutrition of expectant mothers in the special areas of England and Wales was begun in the Rhondda Valley, South Wales, early in 1935. The maternal mortality of this area was high, the average from 1928–34 having been 7·22 per mille. Unemployment and poverty were widespread, and nurses working in the area had suggested the need for better nutrition during pregnancy. The Local Authority was already providing milk on the usual scale, and the administrators of the Birthday Trust Fund determined, in addition, to distribute packets of foods from the antenatal centres to all needy expectant mothers during the last three months of pregnancy. A reduction in the maternal mortality occurred during the year and in 1936, with the help of a grant from the Commissioner for the Special Areas, the scheme was extended to other areas in South Wales and to three county boroughs in the north of England. A similar reduction in the maternal mortality took place, and in 1937 the scheme was still further extended. At the present time it is being carried on in 18 areas in South Wales and in 12 areas in the north of England, and it is expected that approximately 12,000 expectant mothers will have received the foods during the financial year 1937–38.

The scheme had been started as a charitable effort to relieve distress among the very poor, but the reduction of maternal mortality which took place among the women who had been helped aroused general interest, and the Joint Council of Midwifery which had hitherto administered the Fund, appointed a small research committee, mainly medical, to watch the progress, scan the results, and keep in close touch with the areas.

In a scheme of this kind improvement may be sought in three main directions—reduction of maternal mortality, reduction of maternal morbidity, and reduction of infant deaths, including stillbirths.

The effect as regards maternal mortality may be estimated in two ways. The mortality during the year of the experiment may be compared with the average mortality of a number of previous years. For decisive evidence on this point the experiment would have to extend over a good many years, in order to avoid errors due to changes in mortality rates which may occur in the same place from year to year. By the second method the mortality of the mothers who have received the foods may be compared with that of mothers in the same area who have not received the foods. For this method to be of value we must show that the two groups of mothers are fairly comparable. The women who receive the Birthday Trust foods are mostly the wives of unemployed men, and as they receive the packets from the antenatal centres they have the benefit of antenatal care. The women of the control group are in some cases better-to-do women who receive antenatal care from their own doctors; in other cases they are better-to-do women who attend antenatal centres, but do not

receive foods. There are, of course, many who attend no centre and get no antenatal care. It has been suggested that the Birthday Trust group, being drawn from antenatal centres, would in any case have a lower mortality than the control group, of whom only some receive antenatal care. But although antenatal care undoubtedly saves many lives it does not follow, I think, that the women attending antenatal centres necessarily show a lower rate of mortality. The difficult cases tend to collect at the centre for advice and the normal cases tend to remain at home. The centres have a larger number of primiparæ, as mothers are more anxious for instruction during the first pregnancy. And the medical officers sometimes complain that the mothers whose names are entered at the centre fail to attend regularly or follow instructions given. The success or otherwise of antenatal centres in reducing mortality no doubt depends partly on the organization and will vary in different areas. In examining the comparability of the groups one matter is important. The maternal mortality of the areas is swelled by cases of septic abortion, but in the figures collected by the Birthday Trust all such cases are excluded from both groups. Only deaths which take place during the last three months of pregnancy are included.

The following table shows the figures obtained up to the end of June 1937 [1] :—

PARTICULARS OF RESULTS OF NATIONAL BIRTHDAY TRUST FUND NUTRITION SCHEME FOR EXPECTANT MOTHERS FROM JANUARY 1, 1935, TO JUNE 30, 1937.*

Period	Total number of mothers receiving food	Puerperal death-rate from sepsis	Puerperal death-rate from other causes	Total puerperal death-rate	Maternal death-rate from associated causes	Infant death-rate (including stillbirths)
CASES RECEIVING SPECIAL FOOD.						
1935/1936 ...	7,320	0·14	1·50	1·64	Not available	Not available
1937 ...	3,064	—	1·63	1·63	0·98	57
Total ... 1935, 1936 and 1937	10,384	0·09	1·54	1·63	—	—
CASES NOT RECEIVING SPECIAL FOOD.						
1935/1936 ...	14,073	3·48	2·91	6·39	Not available	Not available
1937 ...	4,781	1·25	4·18	5·43	2·09	102
Total ... 1935, 1936 and 1937	18,854	2·91	3·24	6·15	—	—

Note.—All rates in the above table are calculated per 1,000 total births.

* Reproduced with acknowledgments from *Publ. Hlth.*, 1937, **51**, 2, 59.

The table shows that among 10,384 mothers who received the Birthday Trust foods, the death-rate from puerperal sepsis was only 0·09 per thousand (representing one death), while in the control group of 18,854 mothers who did not receive the foods the death-rate from puerperal sepsis was 2·91 (representing 46 deaths). Maternal death-rate from other causes was about 50% less, and infant death-rate (only kept during the last six months) was nearly 50% less in the Birthday Trust mothers. These figures are rather remarkable, especially as they relate to puerperal sepsis.

As regards the morbidity of mothers, figures were given for the incidence of puerperal sepsis, and worked out at about 50% less for the Birthday Trust mothers. These figures were, however, not published, as we were not satisfied that they were sufficiently accurate. A new method of record-keeping has been introduced, which will in future give more accurate results.

If we take it for the moment that these favourable results are due to the foods given, the question arises, why ?

The foods first given in 1935 were brandox, ovaltine, and marmite. In 1936 brandox was discontinued and ostermilk given. Recently ovaltine has been discontinued in some areas and colact substituted. Speaking generally, the Birthday Trust provides for each woman 3 lb. of milky foods and half a pound of marmite per month for three months previous to the confinement, or, if the medical officer

prefers, it may be given for nine weeks before delivery and for three weeks after. It will be noticed that the foods given are not such as to provide the protein and calories which are so lacking in the diet of these poor mothers, and there is no fear that the mothers will suffer from the bad consequences of too much food. Is the improvement due to better general nutrition due to the increased milk and vitamins causing a greater resistance to disease, or is it due to any one element which may have a special effect on pregnancy and childbirth ?

During the last few months I have visited all the areas where the foods are being given and have talked with the medical officers and health visitors, and sometimes with the mothers as well. There seems to be a good deal of doubt as to how far the milky foods are taken by the mother and how far they are shared with the family. It is a psychological fact which we must remember, that in times of scarcity a mother will always sacrifice herself for her children, and she knows, of course, how valuable these milky foods are for the young children. Sharing some of the milky foods within the family is difficult to prevent. Marmite is rather different—it is not so popular with the mothers, but they can usually be persuaded to take it. It is not, as a rule, popular with young children, nor do the mothers look on it as a particularly suitable food for them. It is probable, therefore, that the mother takes most of it herself.

Marmite contains practically no carbohydrate or fat and only a small amount of protein, but it is rich in vitamin-B complex. The Marmite Company state that samples tested have been found to contain 840 international units of vitamin B_1 per ounce. If these expectant mothers take the whole of the marmite given them—2 oz. per week—they will be getting 230 international units per day in addition to what they may get from milk or other articles of diet. The amount required by the Advisory Committee of the Ministry of Health in its recent report on Nutrition [2], for the pregnant woman, was a minimum of 150 international units per day. It is evident, therefore, that even if the Birthday Trust mothers take less than the full amount of marmite given them they are still having a diet exceptionally rich in vitamin-B complex.

A good deal of experimental work has been done on vitamin-B complex and especially on vitamin B_1 with regard to pregnancy, but mainly as it affects the young. As far back as 1927 Moore and Brodie [3] estimated that for a successful pregnancy in rats four times the normal amount of vitamin B_1 must be given, and this has been confirmed by many other workers. We know that vitamin-B complex is a neuro-muscular stimulant and it is not unlikely that a mother fed on it during the last few months of pregnancy may be able to deliver herself naturally when she would otherwise have required operative intervention. It also improves the appetite and increases the power of digestion and assimilation, so enabling the mother to make the best use of the food she can get. It has a special action on the skin and mucous membranes, helping to preserve the integrity of the epithelium and so preventing the passage of germs into the body. This may explain the reduced tendency to puerperal sepsis, and the reduced death-rate also may be due to the increased power of resistance.

During the past year the Research Committee has taken certain steps with a view to answering the questions outlined above. In certain areas a specially prepared yeast extract is being used instead of marmite, equally rich in vitamin B. In some areas this is being given, as is the marmite, along with the milky foods, as described earlier. In some areas it is being given alone, without other foods, and marmite also is being tested this way. In some areas marmite and yeast have been entirely discontinued and minadex, rich in vitamins A and D, is being given with the milky foods. There will, therefore, be several groups to compare: (1) women having marmite (or wheat extract specially prepared) alone; (2) those having marmite (or the same wheat extract) with milky foods; (3) those having minadex with milky foods; (4) women getting no special foods.

During the past year the Research Committee has issued printed cards and has asked the medical officers to fill them up for each maternal or infant death or stillbirth, both in the Birthday Trust and in the control group. It has asked that, if possible, the cards may be filled up for each woman who receives the foods, as in this way much more detailed information will be obtained about morbidity. The difficulty is that the time of the medical officers, health visitors, &c., is so much taken up by routine duties, that they have little time for keeping extra records. The antenatal clinics of the country offer a fine field for clinical research, and if special workers could be appointed to carry out investigations from time to time, much more light might be thrown on the problems of maternal and infant mortality.

In conclusion, it may be said that the success so far attained by the Birthday Trust scheme is due, apart from its good fortune in getting a grant for the Commissioner, to the fact that in forming the scheme it took advantage of the existing facilities of the antenatal centres, that it succeeded in getting the valuable and wholehearted co-operation of the medical officer and other workers in the areas and perhaps that it picked out among its foods certain essential elements which are needed for a successful pregnancy.

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Clinical Section

President—B. T. PARSONS-SMITH, M.D.

[*April* 8, 1938]

Rhinophyma.—DUNCAN C. L. FITZWILLIAMS, C.M.G., F.R.C.S.

T. M., male, aged 68, admitted to St. Mary's Hospital, Paddington, March 31, 1937, with a large rhinophyma dating from 1917.

The growth had come on gradually and at the time of admission was 4 in. across, 1½ in. vertically, and at least 1 in. thick (fig. 1). There was some obstruction to

FIG. 1.—April 1937.

FIG. 2.—February 1938.

the breathing but otherwise there was no trouble. Owing to its gradual onset the patient had become accustomed to the growth and it did not distress him very much.

On April 2, 1937, the nose was whittled into shape with a diathermy knife; in the left lobe of the growth a large cyst was found. The bleeding was not excessive. The mass was removed sparingly as it was thought better to perform a second

operation to mould the nose into a good shape later. This however has never been done as the patient seems to be quite content with the condition as it is (fig. 2), but there is no doubt that a really handsome nose could be fashioned.

Pathological report: Rhinophyma, with much organizing granulating tissue and fewer sebaceous glands than usual.

Osteitis Deformans (Paget) with Pre-tibial Calcareous Nodules.—F. PARKES WEBER, M.D.

This case was shown before the Section of Dermatology on December 16, 1937,[1] under the heading "Multiple subcutaneous phleboliths over the tibiæ", but I expressed some doubt as to whether the calcified "pre-tibial" nodules were really phleboliths.

FIG. 1.

FIG. 2.

The patient, Mrs. M. H., aged 60, is a well-built woman, who has enjoyed good health, but has lately complained of a tendency to cardiac palpitation on exertion, and she has osteo-arthritic symptoms. In the course of a general examination the presence of early osteitis deformans (Paget) was discovered, particularly of the skull, a radiogram of which showed the characteristic woolly appearance (fig. 1). The blood-Wassermann reaction was negative. Brachial blood-pressure 140/100 mm. Hg. The many minute hard nodules in the subcutaneous tissue over both tibiæ were easily felt, and well demonstrated by radiograms (fig. 2). I thought they were phleboliths, though they were not all obviously connected with the dilated superficial veins in the legs, which could hardly be termed varicose veins.

Such pre-tibial calcified nodules are not exceedingly rare. My attention was first drawn to them by Sir Dyce Duckworth about 1891 (or earlier): they cause no

[1] *Proc. Roy. Soc. Med.*, 1938, **31**, 346.

subjective symptoms, as far as I know. They occur chiefly in elderly women and, according to Weissenbach, Françon, and Robert (*Paris médical*, 1932, **85** (ii), 28, and *Semaine des Hôpitaux de Paris*, 1933, **9**, 370), are mostly associated with osteo-arthritis. Poirier (*Bull. Soc. Anat. de Paris*, 1887, **62**, 95, 115, 148, 544) drew attention to them and thought some of them might be due to calcification of fat-lobules, and that occasionally they might contain true bone.

Dr. PARKES WEBER said that at the German Hospital recently there had been several remarkable examples of osteitis deformans, including one which had begun at a relatively early age (in a man), of an extremely so-called "fibrocystic" type and was associated with bone-fracture. Another patient was a woman, one of three sisters all affected with osteitis deformans of cranial predominance. The cranial disease in her case had become complicated with osteogenic sarcoma (*see* H. Rast and F. P. Weber, *Brit. Med. Journ.*, 1937 (i), 918).

Another Member of an Acholuric (Spherocytic) Jaundice Family described in 1910.—F. PARKES WEBER, M.D.

The patient, E. T., when I saw him in 1909, was aged 12 years and was then the least jaundiced of the jaundiced members of the family which I described with G. Dorner in the *Lancet*, 1910 (i), 227. The spleen and liver could only just be felt below the ribs. Blood-count: Hæmoglobin 69%; erythrocytes 3,920,000; leucocytes 10,700 (of which 65% were polymorphonuclear neutrophils); one neutrophil myelocyte was counted and three nucleated red cells were seen during the count of 500 white cells. The resistance of the red cells towards graduated hypotonic sodium chloride solutions was decidedly below the normal, hæmolysis commencing with the 0·64% solution. The blood-serum was abnormally yellow; it gave a negative Wassermann reaction. Some of the patient's cervical lymph glands were slightly enlarged and there was an operation-scar on the neck.

During the Great War he did heavy artillery work and afterwards had a complete breakdown, with severe anæmia and great splenomegaly. Splenectomy was performed by Professor G. E. Gask on January 21, 1921, with the usual satisfactory results (*see* E. Coldrey, *St. Barth. Hosp. Journ.*, 1921, **28**, 106); at the upper pole of the excised spleen there was an area of anæmic infarction. Some time later (1922) cerebral symptoms developed, possibly due to a thrombotic disturbance. In 1927 the vermiform appendix was excised and some gall-stones were removed. In 1936 the patient underwent an emergency operation at St. Bartholomew's Hospital for perforated gastric ulcer. He now looks well and works at an open-air greengrocery stall, but still has slight motor defect in his left hand and leg as remnant of the cerebral trouble of 1922.

Multiple Cysts of Kidney, simulating Mesenteric Cysts.—A. SIMPSON-SMITH, F.R.C.S.

Joyce R., aged 1 year.

When she was 6 months old, her mother noticed a swelling of the left side, and this gradually extended throughout the abdomen.

On examination.—There is a large fluctuant multilobed translucent swelling lying across the abdomen and extending into the left loin. Uroselectan and cystoscopy examinations showed no abnormality.

Operation.—A left renal tumour containing many large cysts in its lower half was removed through an ordinary laparotomy incision. The ureter of the excised specimen was immediately injected with sodium iodide, and an X-ray photograph taken. The renal pelvis was exactly as depicted in the uroselectan, but with the addition that all the large cysts had now filled with opaque fluid, thus showing the superiority of an ascending over a descending pyelogram.

Endocrinal Obesity (Hypothyroidism) with Œdema of the Legs, Osteo-arthritis and Hypertension.—PHILIP ELLMAN, M.D.

Mrs. A., aged 48. Three children.

Four years' history of increasing swelling of abdomen and legs, with pains in thighs and "bearing down" pain on standing. Dyspnœa and increasing weight had become so marked that the patient was unable to dress herself and was more or less confined to bed. She gained weight slowly; four years ago she weighed 17 st. Since then the increase has been more rapid, and on her admission, under my care, to the Rheumatic Unit at St. Stephen's Hospital in December 1937, her weight was 21 st. 4 lb. Periods regular.

On examination.—An obviously obese subject. Movements slow. Thinning of eyebrows. Large apron of abdominal fat, with irreducible umbilical hernia. Characteristic myxœdematous pads of fat on lower limbs, &c., with marked limitation of flexion at knee-joints owing to excessive fat. Early osteo-arthritic changes in these joints.

Investigations.—Heart: Distant heart sounds; aortic second sound relatively accentuated; blood-pressure 190/115; no evidence of failure. X-ray examination of heart: Heart within limits of normal in shape, size, and position; diaphragm high. Electrocardiogram normal. Blood sedimentation rate 7 mm. at the hour. Wassermann reaction negative. Basal metabolic rate + 8·4%. Skiagram of knees: Some irregularity of joint surface and early osteo-arthritic changes.

Treatment.—Physical: Radiant heat bath; lymphatic massage; faradism to arms, legs, and abdomen. Later, remedial exercises and rowing machine. Medicinal: Thyroid extract, gr. ii, t.i.d.; ammonium nitrate and novurit suppositories. Dietetic: 900 to 1,000 calories, low carbohydrate diet, salt-free; restricted fluids.

Results.—Following treatment, the patient has lost 5 st. in weight, is able to walk well, and has an almost full range of movement of the upper and lower limbs which now show some signs of shape of the ankles. The œdema has almost subsided. There is marked reduction in the measurements of ankles and calves.

Dr. PARKES WEBER said he thought the case was one of true hypothyroidism, with myxœdematous changes (loss of eyebrows, &c.), obesity and arterial hypertension and actual œdema (not rarely associated with untreated myxœdema). The improvement had, he thought, been mainly due to the thyroidal treatment, though the other measures had greatly assisted in the excellent result which had been obtained.

Pseudo-hypertrophic Muscular Dystrophy, with Genital Dystrophy and Obesity.—J. H. G. MASON, M.D. (for Dr. THOMAS HUNT).

R.C., male, aged 12. Weight 3 st. 12 lb.; height 3 ft. 10 in.

The patient has suffered from increasing weakness of legs and arms for the last seven years; he is now unable to raise his arms or to stand up. There has been considerable increase in weight during the last three years.

Family history.—Parents healthy; one sister died from renal disease. No obesity in family.

Physical examination.—Marked wasting of supra- and infra-spinati, pectorales and quadriceps muscles; no wasting of glutei; marked pseudohypertrophy of deltoids and gastrocnemii. Face and hands small. Bilateral talipes. Testes small; descended. Very scanty growth of pubic hair.

Skiagram of skull: normal pituitary fossa. Optic fundi normal.

Urine: No abnormal constituents; output normal.

Wassermann reaction negative. Blood-pressure 110/80.

Blood-sugar curve :

Fasting	131 mgm. per 100 c.c.
½ hour after 50 grm. glucose ..	138 „ „ „
1 „ „ „ „ ..	163 „ „ „
1½ hours „ „ „ ..	140 „ „ „

Blood-count: R.B.C. 3,900,000; Hb. 80%; W.B.C. 11,600 (polys. 57%).

Dr. PARKES WEBER said he also thought the case was one of primary muscular dystrophy of pseudo-hypertrophic type, without pituitary disease.

Chronic Pulmonary Tuberculosis treated by Introduction of Air into the Anterior Mediastinum (Artificial Pneumomediastinum).—ELIO MONTUSCHI, M.D. (for Dr. ERNEST FLETCHER).

M. S., aged 27, female, has complained of pain and swelling in both ankles periodically since 1932. Has recently had a slight cough with a little sputum and some dyspnœa on exertion.

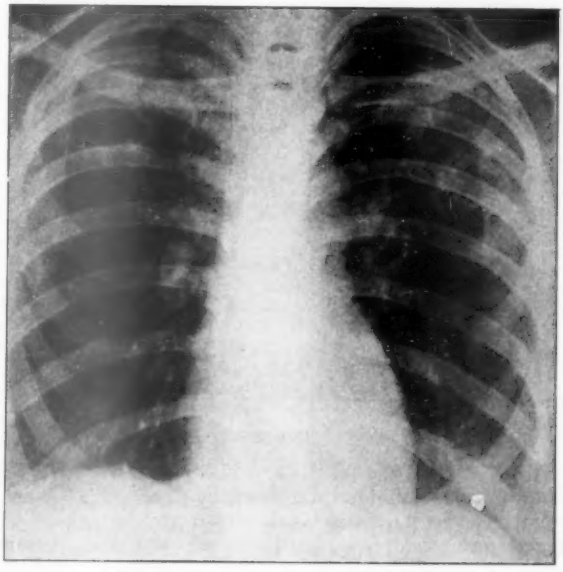

FIG. 1.

Nothing of importance in past history or in family history. Admitted to hospital January 22, 1938.

Condition on examination.—Upper respiratory tract normal. Chest: Diminished air entry over right apex; a few crepitations. Heart normal in size; central; soft systolic murmur at apex. Blood-pressure 97/56.

Skiagram of chest (fig. 1): Infiltration at the left apex; large cavity at the right.

Pathological investigations.—R.B.C., 3,960,000; Hb. 70%; C.I. 0·88; W.B.C. 10,000, with normal distribution.

Blood sedimentation rate 45 mm. at the hour. Sputum contained numerous tubercle bacilli.

Urine: Albumin, by Esbach's method, 0·1 %, with occasional white blood-cells, sterile on culture.

Progress.—The patient was pyrexial in the early stages but gradually the temperature fell to normal and an artificial pneumothorax was attempted on the right side but failed. February 7: 300 c.c. of air were introduced into the anterior

FIG. 2.

mediastinum following the technique laid down by Condorelli. A needle 3 in. long and 1 mm. bore, curved in its distal third, was introduced above the upper edge of the manubrium sterni and passed gradually down so that it came to lie in the anterior mediastinum behind the upper part of the sternum. Initial pressure was slightly po itive and there was a pleural swing. An ordinary artificial pneumothorax apparatus was used and air was introduced at a pressure of + 25 cm. of water. The air was cut off and the pressure rapidly fell to +5, +2, 0. The final pressure after the introduction was again 0, the pleural swing still being seen.

Further refills have been given of 350, 600, 350, and 400 c.c. of air and no untoward effects have been observed. A further skiagram (fig. 2) shows a pleural hernia at the right side and air may be noticed at the left border of the heart, There seems to be some improvement in the X-ray appearances but the sedimentation rate on March 28 was 57 mm. at the hour.

Comment.—This case is shown to illustrate the possibility of employing an artificial anterior pneumomediastinum in certain cases of pulmonary tuberculosis.

This procedure was first employed by Condorelli (1936) as an aid in the diagnosis of pleuro-pericardial and sterno-pericardial adhesions ; the introduction of air made the visualization of these adhesions possible. Condorelli says that the mediastinum is divided anatomically into two portions, anterior and posterior, by an expansion of the posterior layer of the middle cervical fascia. Air is introduced under moderate pressure and infiltrates the lax connective tissue of the anterior mediastinum—if it is introduced anteriorly to the layer of fascia mentioned above—forming a retrosternal bulla which enables this space to be visualized in a lateral skiagram. It also constitutes an air chamber round the anterior and lateral aspects of the heart.

Catalano (1936) showed that recent pleural herniæ following an artificial pneumothorax could be reduced by this procedure.

Vercesi (1937) was successful in controlling severe hæmoptysis by this method and held the view that the control he obtained was due to an artificial collapse of the lung.

Artificial pneumomediastinum is not intended as a substitute for artificial pneumothorax—which should be done whenever possible—it is limited entirely to those cases in which the lung lesion is mostly paramedian and anterior.

The technique is very simple and is devoid of danger, no untoward effects having been observed following its use. Care must, of course, be taken that the needle does not penetrate a vein, the left innominate being the most likely to be injured, so that before any air is put in, the piston of the syringe must be drawn back. Subcutaneous emphysema is occasionally noticed but is never very marked or extensive.

The simplicity of technique and the lack of danger are of great importance and appear to justify tentative trial of the method on a large scale, and this might extend the scope and field of application of the procedure.

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Eventration of the Diaphragm.—Elio Montuschi, M.D. (for Dr. Ernest Fletcher).

G. C., aged 64, female, has, for many years, complained of dyspnœa, palpitation, and a sense of fullness after meals. Has winter cough and moderate amount of sputum. Can sleep only on the left side. A year ago began to complain of pain and stiffness in the left hip and knee ; the joints on the right side are affected in a minor degree.

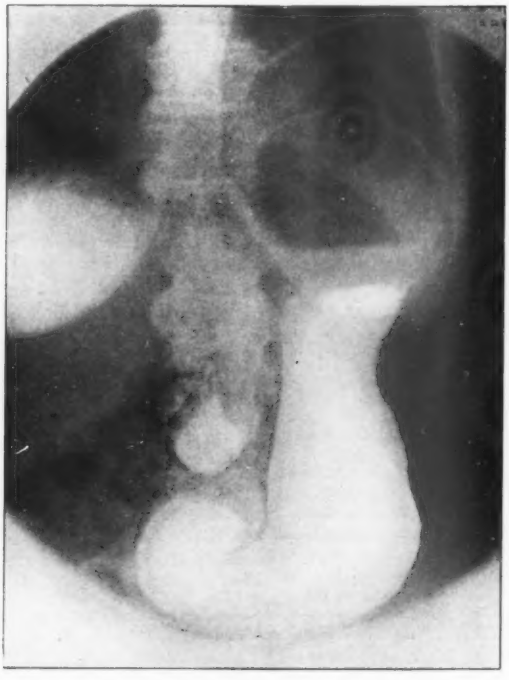
Past history.—Hysterectomy at age of 39, for fibromyomata of the uterus. Pleurisy (?) at age of 56. Nothing relevant in family history.

Condition on examination.—Cyanosed ; rather overweight. Chest : Base of left lung expands badly and there is loss of vocal fremitus ; breath sounds diminished ; crepitations heard. Borborygmi heard clearly over base of left lung. Heart : Displaced to right ; apex-beat 3 in. from mid-sternal line ; the right border is well

to right of sternum. First sound at apex impure ; second aortic sound very loud. Occasionally the heart sounds can be heard very distinctly posteriorly. Litten's phenomenon absent. Abdomen : No abnormal physical signs noticed. Limbs : Signs of osteo-arthritis in both knees and in the left hip.

Skiagrams : Knees and left hip show osteo-arthritic changes. Chest : Left diaphragm raised about two spaces, with some displacement of heart to right.

Barium meal shows eventration of the diaphragm but no herniation (*see* fig.).



Eventration of the diaphragm.

Pathological investigations.—R.B.C., 5,100,000 ; Hb. 94% ; C.I. 0·92. W.B.C. 6,400 (normal distribution).

Blood sedimentation rate 2 mm. at the hour. Sputum examination : No tubercle bacilli present. Electrocardiogram : Normal ; no marked axis deviation.

Comment.—An unusual feature of this case was the fact that the heart sounds could be heard so clearly at the left base behind. The probability is that this phenomenon has a very simple physical explanation but it is important because it is unusual. In left-sided eventration of the diaphragm the heart is generally displaced to the right and it is so in this case, so it seems probable that the sounds are transmitted by the air in the stomach to the left base.

Congenital Parietal Foramina.—R. W. B. ELLIS, M.D.

K. W., male, aged 20 months, a healthy baby referred to the Infants Hospital on account of cranial defect. Full term, normal delivery, birth-weight 7 lb. Now taking mixed diet for age, and cod-liver oil emulsion. No symptoms of disease.

The father is alive and well. The mother has two flattened areas in parietal region, on either side of mid-line, but these do not form complete foramina. One older child died of gastro-enteritis.

FIG. 1.

FIG. 2.

On examination.—A well developed and well nourished infant, behaving normally for his age. There are two sharply-demarcated roughly circular foramina, 2 to 3 cm. in diameter, in the parietal region, lying on either side of the mid-line and separated by a bony bridge, 0·5 to 1 cm. in width.

Radiological examination confirms the character of the foramina and shows that the posterior margins reach the lambda.

Dr. PARKES WEBER said he had shown three members of a family with similar large parietal foramina at the Section for the Study of Disease in Children on October 25, 1935 (*Proceedings*, 1936, **29**, 122). The greatest number of similar cases (16) in one family (the Catlin family) had been recorded by W. M. Goldsmith, *Journ. of Heredity*, 1922, **13**, 69. Pepper and Pendergrass had given details of the Thompson family, in which nine members were affected (*Amer. Journ. Roentgenol. and Rad. Therapy*, 1936, **35**, 1). Caussade, Neimann and Mariot reported nine examples in three generations of one family (*Presse médicale*, 1937, **45**, 1123).

Splenomegaly with Reversal of Wassermann Reaction from Positive to Negative.—G. H. ROSSDALE, D.M.

D. B., female, aged 28, complains of pain in left side.

Family history.—No evidence of syphilis.

Past history.—Aged 15: Spleen enlarged. Wassermann reaction *negative*. Blood-count suggested Hodgkin's disease. Aged 18: Spleen enlarged. Occasional hæmatemesis. Blood-count suggested Banti's disease. Aged 25: Amenorrhœa and pain in left side, 3 months. Facial and general pigmentation of skin (light bronze).

Spleen enlarged. Hard mass four fingerbreadths below left costal margin, palpable in mid-line and in left flank. Very tender on palpation.

Liver tender but not enlarged. Blood-counts showed hypochromic anæmia and leucopenia. Fragility tests normal. Platelets 35,000. Splenic puncture : Gaucher's cells not found. Wassermann reaction *positive*.

Progress.—The anæmia responded to treatment by iron salts. During 1935, 1936, and 1937, antisyphilitic remedies were given. The Wassermann reaction (blood) became *negative* in December 1937. The spleen continued to be very painful on palpation, but its size was reduced by about one-third.

Section of Epidemiology and State Medicine

President—Sir ARTHUR MACNALTY, K.C.B., M.D.

[*March* 25, 1938]

Shell-fish and the Public Health[1]

By R. W. DODGSON, O.B.E., M.D., M.R.C.P.

Consultant for Shell-fish Services (late Director), Ministry of Agriculture and Fisheries.

THAT shell-fish from polluted beds are potential vectors of typhoid fever and other diseases, and consequently a standing menace to the public health, is a proposition which I think has passed the stage of legitimate controversy, and I do not therefore propose to devote any time—except incidentally—to this aspect of the question. Disbelief still manifests itself in some quarters, notably amongst the fishermen, who are sceptics almost to a man, and amongst the less instructed vendors, with whom the wish is father to the thought. I mention this apparently irrelevant fact in view of the attitude of a section of the public. Many people, apparently reasonably intelligent, prefer to discard official warnings as proverbially suspect, and to consult the fishermen or the vendors, on the plea that "*they must* know". A further section, especially the consumers of the cheaper varieties of shell-fish, is indifferent. On the other hand, a very large section, comprising probably the majority, is rightly suspicious of shell-fish, with a consequent serious prejudice to the industry—a prejudice accentuated, at times, to a crippling intensity, as, for instance, after the recent outbreak of typhoid at Croydon. With such scares I have no quarrel, the basic hypotheses involved being sound.

During the concluding five or six years of the last century, and the first decade of the present one, much was heard about shell-fish-borne typhoid, and Conway mussels may almost be described as having been the "star turn", constant attention having been directed to them as a result of complaints by health authorities. Amongst others, a careful analysis of the cases of typhoid occurring in Manchester over the period 1906–1912, by the late Dr. Niven, the Medical Officer of Health for that city, provided a crushing indictment.

SHELL-FISH PURIFICATION. INCEPTION AND PROGRESS

As a result of the well-merited evil repute of Conway mussels, the fishery was closed in 1911, and the position thus created was brought to the notice of the Ministry of Agriculture and Fisheries by the Conway Corporation, with a view to a solution of the problem being sought. The Ministry, not only apprehensive for the fate of the industry in general, but alive to the urgent necessity of stopping this gap in the nation's defences against infectious diseases, took the matter up. The Conway Mussel Order of 1912 was passed, one of its provisions being that no mussels should be taken from the fishery except for relaying in a suitable place within the fishery

[1] The paper was illustrated by a cinematograph film.

for such time as should be found necessary to achieve purification. This stipulation was made on advice based upon the observation that shell-fish would become purified if relaid in clean water. Unfortunately, in practice, no suitable—that is to say clean—place could be found ; a difficulty which presents itself at most, if not all, polluted fisheries. (I may mention, here, that there are other serious objections, which practically exclude purification on natural relaying beds, but which I have not time to discuss now.) It was further realized that nothing in the way of deviation of sewers, or the rendering of effluents innocuous, could be attempted at Conway or elsewhere. Experiments in artificial purification were therefore undertaken, with the result that a satisfactory system was evolved, which has been in continuous operation at Conway for twenty-three years, and since extended to Lytham (three years), and to Brightlingsea (four years) for the purification of oysters ; in every case with complete success. The contrast with the pre-purification period, when constant complaints were received, has been striking, for no complaint of illness attributed to the consumption of the purified shell-fish has been received during the whole twenty-three years. (I suppose I ought to refer to one complaint made of several people becoming ill after a family banquet at which Conway mussels were consumed, together with other delicacies. Investigation, however, conclusively proved that the worst sufferer had eaten no mussels.) It will be realized that this experiment has been conducted on an adequate, and I think convincing, scale, when I mention that about 14,000 tons—that is to say some 400,000,000 mussels, representing perhaps 25,000,000 individual consumers—have been marketed from Conway alone. About 10,000,000 purified oysters have also been distributed.

So much for complaints having an epidemiological bearing. There are other categories, however.

During the twenty-three years of purification, we have had a round half-dozen complaints from the markets that the mussels (never oysters) were unsatisfactory, for one reason or another. All such complaints were closely investigated, mostly at the markets concerned, and none of them was found to be significant. In some cases it was merely a matter of mussels kept for a week or more, which had undergone putrefaction. In others, an adventitious " dirty " appearance of the shells, due to the detritus of barnacles crushed in transit, was the trouble. In one case it was shown that " condemnation by consent " was at the bottom of it. In that case the vendor, being glutted on a bad market, surrendered the mussels for destruction—thus avoiding the necessity of paying the fishermen for them. A final case may be cited, as illustrating the vigilance necessary to prevent purification getting a bad name through nefarious practices. A bag of mussels was sent, at the request of a health authority, to a dealer in a certain city, in order to introduce them to that market. The dealer, for reasons of his own, did not want them. It was stated that many of the mussels (some eighteen hours after despatch) were dead and stinking, and were generally filthy. An appalling bacteriological report followed. The mussels were rightly condemned and destroyed—incidentally, before the report reached us. It was clear that it was a case of substitution, but proof sufficient to carry conviction to all concerned was difficult to adduce. The dealer had, however, like most criminals, omitted to cover his tracks in one small detail. The substituted mussels were mixed with—to quote the sanitary inspector concerned—" large quantities of brown seaweed ". Of course no particle of seaweed is ever to be found amongst purified mussels. As it was, some harm was done, as the fact of condemnation was assiduously broadcast by interested parties.

We have also had, on occasion, complaints based on bacteriological examination. I hope to show, later, that such complaints were without significance, except in so far as they indicated the desirability for consideration of the revision of bacteriological tests and standards as applied to shell-fish in general and to purified shell-fish in particular.

No Deterioration caused by Purification

I may mention, at this point, that neither mussels nor oysters undergo any deterioration, in taste, in keeping qualities, or in any other way, as a result of purification. In the early days frivolous tales were spread about the mussels, mostly by disgruntled fishermen, but criticism is silenced by the fact that reliable judges of mussels, including representative connoisseurs from countries where mussels are a national dish (namely France and Belgium), prefer the purified shell-fish. More important, perhaps, is the fact that, recently, rumours originated and insidiously spread by interested parties, that purified oysters suffer in taste and keeping qualities, obtained a rather wide credence. In consequence, an exhaustive series of *ad hoc* experiments, extending over six months and covering the widest variations in temperature and other conditions at the purification tanks, was undertaken by the Ministry, with the result that such charges were found to be without a shadow of foundation. (I may add that the erroneous belief in deterioration was strengthened by the fact that certain perfectly honest and disinterested persons laboured under the delusion that the Brightlingsea process was similar to a process at one time tried out in France—an admitted failure and long since abandoned.)

Before proceeding to technical details, I may refer to two other points: the one epidemiological and the other commercial.

Shell-fish-borne Typhoid To-day

The incidence of typhoid is now reduced to such relatively small proportions that the role of shell-fish in its dissemination and perpetuation is liable to be somewhat overlooked. There is, however, still a definite dribble of individual cases or minor epidemics attributed by medical officers of health, in many instances after very careful analysis of the circumstances, to the consumption of both mussels and oysters. Only during the last few weeks I have been in touch with the authorities concerned in the investigation of four cases attributed to mussels, and presenting some specially interesting features. A rather striking fact is that in the earlier days of purification we had, locally, some five cases occurring at different times amongst " poachers " of unpurified mussels. More recently, similar instances of small epidemics, due to mussels illegally marketed from closed beds, have occurred. Oysters from certain of the more fashionable beds (if I may use the term) have been incriminated by competent authorities in perhaps a dozen cases in the last couple of years; and so on. One series of recent cases was attributed to mussels carrying an imposing certificate that they had been treated at a " purifying station ", which has long functioned—in my opinion—rather as a " polluting station ". Small though the actual number of cases may be, they acquire a more definite significance when we consider the relatively small number of shell-fish consumers in relation to the population as a whole, especially in respect of some expensive luxury oysters, which have a very strong indictment to meet. The almost universal system of insurance against damages tends to induce a cynical attitude amongst shell-fish planters and vendors, and is, in respect of its repercussions on the epidemiological position, an unmixed evil. (I may add, as a sort of stop-press, that within the last few days I have learned the details of two more recent cases attributed, on very strong presumptive evidence, to shell-fish.)

Economics of Purification

My second point is relative to the economic position. The Conway installation is self-supporting. The purification fee is on a sliding scale, being fixed to cover all expenses with a small balance for contingencies. At present it is 1s. 1d. per bag of 1¼ cwt. Even the fishermen refrain from grumbling—perhaps not unmindful of the fact that their small community has benefited to the extent of at least £100,000 as a direct result of purification.

The fee for oyster purification is higher, owing to larger capital charges (unduly large at Brightlingsea, as a result of the abnormal expenses attaching to an economically unsuitable site, and initial engineering difficulties which I need not particularize). It is, at present, 10s. per 1,000 oysters. This fee caused tribulation among the planters, and predictions of early closing down owing to the losses incurred. In practice, the output of the tanks has, to date, consistently and materially increased, whilst certain planters import very large consignments of Portuguese oysters (that is to say, the cheapest variety) for treatment in the tanks, from beds upon which there is no ban and consequently no obligation to purify. I imagine that they do not do this for the purpose of courting loss.

Having given a bird's-eye view of the general position and the results achieved, I will now briefly describe the process and its rationale, with a discussion on the bacteriological principles involved.

Steps in Purification

The exigencies of time preclude a lengthy description of the stages of the purification process ; the necessary condensation will, however, serve to emphasize its extreme simplicity.

The mussels are spread by the fishermen, without undue violence, two deep, on wooden grids in large concrete tanks. They are then, after hosing with high-pressure tap or sterile sea-water to remove mud, given a bath overnight in sea-water sterilized by chlorine and dechlorinated with sodium thiosulphate (the " hypo " of the photographer), and again hosed to remove dejecta. The procedure is repeated over another night, including a third hosing. A final bath for an hour in sea-water containing 3 per million active chlorine (in which the shell-fish remain closed), to sterilize the outsides of the shells, completes the process. The fishermen then enter the tanks in sterilized sea-boots, and transfer the shell-fish to sterilized bags, which are then sealed with dated safety seals.

The purification of oysters is, in the summer (when the output is at its maximum), exactly the same as for mussels, except that a special multiple-jet hose is used to scour thoroughly under the flat shells. When the water temperature falls to or below 54° F., purification is carried out in covered tanks, the water being artificially kept at a mean temperature of 54° F. This taking of the extreme chill off the water (not, be it noted, putting into an enervating hot bath, as some critics have alleged) is necessitated by the fact that all varieties of oysters fail to open, to function, and to eliminate satisfactorily, at the lower temperatures at which mussels are quite happy.

It is unfortunately still impossible to convince everyone that there is not something mysterious and secret—some malign " dosing with chemicals " ; or what not. For want of a better word " process " is used, but in fact, there is no " process " during purification proper. The shell-fish are merely given baths of clean water in which they conduct, unaided, their own process. The chlorine in the final bath merely destroys external bacteria, and rapidly disappears in contact with the shells, and is always all gone long before the shell-fish reach the consumer. This shell-sterilizing bath is not given at the outset of operations, for, though the vast majority of the shell-fish tolerate such a bath perfectly, there are, on occasion, some which display their resentment by keeping closed, and therefore unpurified, during the subsequent purification baths. Moreover, in any case, the final hosing necessitates the final sterilization of the shells as I shall indicate later.

Rationale of Purification

As regards the principles involved in purification. These are wholly physiological.

Shell-fish, of the type under consideration, are extremely efficient animated filters, passing through themselves vigorous currents, actuated by ciliary movement. The gills are highly developed, subserving, predominantly, a nutritional—rather than a

respiratory—function. The circulating water passes through them, and during its passage practically all suspended matter, including bacteria, is filtered out and retained within the shell-fish. Part of it is delivered to the mouth to be ingested and ultimately discharged as fæces, whilst excess is rejected as pseudo-fæces. A small proportion of bacteria may pass the filters to be discharged free into the water, but the number is reduced by successive filtrations, which recur at frequent intervals, as will be realized from the fact that a single mussel can filter at least ten gallons of water in twenty-four hours ; which, in practice, means that the whole of the water in a purification tank (40,000 gallons) may actually pass through the shell-fish some thirty or forty times during a purification period, each time undergoing renewed filtration.

The secret of the efficiency of the purification process resides in the fact that the bacteria are discharged imprisoned in the mucous material of the fæces and pseudo-fæces (fine threads or pellets) which is practically insoluble in water. (Fæcal threads have been kept six months in sea-water, without disintegration.) Such dejecta, loaded with bacteria, lie at the bottom of the receptacle, whilst the supernatant water remains sterile. Any agency which disturbs the dejecta, to the extent of disintegrating them, such as artificial aeration, violent wind action, &c., may stultify purification. (For this reason the tanks are made deep enough to nullify wind action.) Hosing, of course, disintegrates the dejecta ; hence one cogent reason for the final chlorine bath.

As a result of the filtration by the shell-fish, the tank water, often initially very turbid, rapidly clears, and in a couple of hours or less becomes glass-clear. This clearing of the water, with due consideration of the time factor, is taken as the chief criterion in judging the normal functioning of the shell-fish. Shell-fish function more vigorously, and for a longer time, in water containing suspended matter. Hence, artificial pre-filtration is not only unnecessary but actually disadvantageous—unless, of course, it is so defective that suspended matter passes through. [The remarkable action of the shell-fish in filtering out suspended matter was illustrated in the film.]

The keynote of the work during the pre-commercial experimental period, which lasted for a year, was " simplification " ; that is to say, the elimination of anything in the nature of artificial aids to purification, several of which, notably chlorination, had obtained currency as a result of the work of previous investigators.

The shell-fish themselves solved the problem of sterilization with the aid of added bactericides, by resolutely excluding water containing the smallest quantity of such reagents—for instance, chlorine, simple and compound chloramines, acid sodium sulphate, &c.

Artificial currents, aeration, pre-filtration, and so on, all proved to be not only unnecessary but actually inimical to purification.

The experimental period for oyster purification lasted much longer—namely six winter seasons, during which research was concentrated upon ascertaining the optimum temperature necessary to achieve the best results in a practicable time. As I have just said, it was found that results strictly on all fours with those obtained with mussels emerged in the case of oysters, provided the water temperature in the cleansing tanks was maintained between 52° and 56° F.

Other Methods of Purification

I may here briefly refer to other methods of artificial purification. Several processes have been devised and put into operation (two of them have been patented), both in this country and abroad, for the purification of oysters, mussels, and clams. Most of them have been abandoned as failures, whilst others, equally unsatisfactory, are still carried on in a desultory fashion, chiefly (and I say this advisedly) under the stimulus of the fees which are exacted, in certain cases, by irresponsible persons.

I have had opportunities of inspecting typical examples of—I think I am right in saying—all such plants, both at home and abroad. The causes of failure are in most cases only too evident. Briefly, the protagonists of nearly all the schemes, apparently failing to realize the physiological principles involved, and feeling, perhaps, that they " must do something " more or less spectacular, introduce factors which annoy the shell-fish and prevent them getting on with their job of self-purification. This applies especially to cases where active chlorine is used. Failure of any provision for the removal of dejecta is another cause of failure ; whilst violent agitation of the water by forced aeration put another process (long since abandoned) out of court. In other cases the oysters were smothered by overcrowding, and cluttered up with dejecta, the enterprise being killed by what was practically a strike amongst the vendors, who asserted that the shell-fish all died. The system of purification in tanks filled by the tide at half-water has failed fundamentally, because no convenient spot where sewage-free water was obtainable could be found, and unsuitable spots were consequently utilized.

Of course, the size of tanks does not arise. Purification can be done perfectly well in a pint pot. What does matter is reliable, efficiently-trained, and adequately remunerated supervision, which would seriously weight miniature installations. It is more than doubtful whether small and cheap installations could be run, shell-fish for shell-fish, as economically as those on the scale of Conway and Brightlingsea.

Bacteriological and Topographical Considerations

We now come to bacteriological considerations. I may say at once that my own view has always been—and certain recently observed phenomena, to be described later, have strongly reinforced it—that topographical considerations—that is to say, the pollutability of layings—must provide the real criterion in judging the suitability of shell-fish for human consumption, bacteriological examinations being merely complementary, often unnecessary, and not infrequently misleading. In this connexion we have, I believe, ample grounds for deeming approved and properly run purification tanks to be topographically satisfactory within the meaning of the Act.

On the other hand, intensive bacteriological research has, of course, been essential not only in the experimental stage of purification but during the commercial operations. With regard to the latter, certain unlooked-for—not to say startling—phenomena have come to light, and these have entirely altered our general perspective.

The original bacteriological findings have been fully dealt with elsewhere (Dodgson, 1928), and I do not propose, either in this particular connexion or subsequently, to indulge in the recital of too many figures, difficult of digestion on the spur of the moment and in any case liable to obscure important general issues.

Briefly, a standard of purity for purified mussels automatically emerged—namely not more than 5 lactose-fractors (absolute count) per 1 c.c. of minced shell-fish incubated at 37° C. for twenty-four hours. The majority showed no growth. Five was unusual. Extension of the treatment beyond two days did not materially affect the end-result. The lactose-fractor population before purification was usually some hundreds per 1 c.c.

As regards oysters, a similar standard was established during the experimental stage. During the subsequent period of commercial operations, systematic routine analyses have shown markedly better results. Of the 700 individual oysters tested (1 c.c. minced shell-fish) 613 were sterile, the remainder showing from 1 to 2 lactose-fractors. A further 600 oysters tested in pools of five gave similar results. The lactose-fractor population of the unpurified oysters averaged some 50 per 1 c.c., with a maximum of 100. Reports from two municipal laboratories show even better results still. In one case analyses of whole oysters showed lactose-fractor sterility with incubation at 37° C. We may therefore claim that, to date, oyster purification, judged even by the stringent standard of incubation at 37° C., has

approached perfection. (I may add that systematic parallel tests by the Fishmongers Company's method and Dr. Henry's technique showed results of the same order.)

Anomalous Bacteriological Results

To return to mussels. Although an overwhelming majority of continuous routine tests give results well within the original standard of " not more than five "—with a large preponderance of noughts—we have on three occasions encountered what we have called anomalous periods ; one persisting for about six weeks, and the others for a day or two only. During these periods the standard has not only been overstepped, but the counts have been fantastically high—that is to say hundreds, and in some cases a thousand or more, per 1 c.c.

I will pass over the strenuous investigations called for by these happenings, and the precautionary measures of extra treatment, &c., which were taken. Suffice it to say that no fault was found in the purification operations (as, indeed, there hardly could be, in view of their simplicity), or in the mussels themselves, which, as shown by all the usual tests, were functioning vigorously and normally during the period of the worst bacteriological results. (I may add that an unusual mortality amongst the mussels occurred at one time but subsequent extended observation failed to confirm any correlation.)

Paradoxically, the very magnitude of the deviation from the normal appeared, on reflection (that is to say as soon as we had time to reflect), less disturbing than a minor deviation might have been. We were confronted with a new phenomenon, outside the orbit of mere defects in working or of physiological delinquencies of the mussels. Complete omission of the tank operations, or entire suspension of the activities of the mussels, could not have made them worse (for they were apparently much worse) than they were initially.

The first clue was afforded by the observation that all the colonies tested during the anomalous periods proved to belong either to the cloacæ or aerogenes types. This refers not only to the prick-outs from plates but also to the cultures of 1 c.c. of mussel in liquid MacConkey. The *Escherichia coli* types were conspicuous by their absence. Of the strains isolated, all were acid- and gas-positive at 37° C., but failed to grow at 42°, and were killed at 44°. The optimum temperature for the gelatin-liquefiers was 20°. The extreme rarity of these abnormal results has prevented us, during the last two years, from obtaining fresh material, but we originally collected twelve strains, which have provided material for considerable research.

Multiplication of Lactose-fractors in Shell-fish and Sea-water

To cut a long story short, it was found, as a result of a long series of exhaustive and carefully controlled experiments, that organisms of the types just described may, at times, multiply enormously in mussels, barnacles (with which the mussels are thickly studded), and in raw sea-water, in sterilized tank-water, and in water recovered from the shell-cavities of purified mussels (taken with precautions to prevent laceration of tissue).

In spite of the prosecution of numerous lines of research, including some which I may describe as rather long shots (for instance the possible influence of variations in the oxidation reduction potential of the waters concerned on the multiplication of bacteria) we have, as yet, no clue to the nature of the conditions determining the anomalous periods, and cannot therefore even begin to legislate for them, even should they be considered significant in the public health aspect. My own view is that they are not.

That multiplication of citrate-positives may occur in purified mussels, well up to standard on despatch, on the way to and at the markets, was abundantly shown, not only by *ad hoc* experiments at Conway, but by actual market experiments carried out in collaboration with Dr. Newsholme of Birmingham and his staff.

A few examples, by no means exceptional, may be quoted. A sample (10 mussels) from a batch, clean on despatch, showed 900 lactose-fractors per 1 c.c., on return to Conway forty-eight hours after despatch. The barnacles from three purified mussels were found to be harbouring some 300,000 citrate-positives, whilst another batch of barnacles which had been sixteen days in the tanks with daily changes of sterile water contained 10,000 organisms of the *B. cloacæ* type in 1 c.c. of crushed barnacle. The mussels to which the barnacles were attached were free from lactose-fractors. In view of the feeding mechanism of the barnacle, and as a result of experiment, the conclusion that multiplication takes place is inevitable. During what we may call the normal conditions, barnacles on purified mussels are usually found to be clean. It is not possible definitely to assess the part played by barnacles in the production of anomalous results, but they are a potential source of post-purification pollution of mussels, as many of them are crushed in transit and their contents liberated. Oysters have never shown any anomalous results. The fact that they carry no barnacles may be of significance or it may not.

With regard to the multiplication of lactose-fractors in water. We have had almost continuous experiments in progress for some two years, with the result that we have been able to confirm, with sea-water, the remarkable results obtained by Bigger (1937) with tap-water. In samples of shell-water from raw, chlorinated, and purified mussels respectively, we have demonstrated multiplication of citrate-positives (i.e. methyl-red negative) obtained during anomalous periods, which, though marked (e.g. from 20 to 20,000 per 1 c.c. in three days), was not of the same order of magnitude as the multiplication observed in autoclaved water, of both citrate-positives and strains of typical *B. coli*, for instance, from tens to tens of millions in a few days.

No Evidence of Multiplication of Organisms of the Typhoid Group

The possibility of the multiplication, or even bare survival, of organisms of the typhoid group has been again explored. Several strains have been used, including the *Salmonella typhi* isolated in the recent Croydon outbreak, and various para strains. Neither in raw nor autoclaved sea-water has any multiplication been observed, nor has survival beyond two or three days been noted, although, in some cases, heavy inoculations of the water were made, e.g. 2,000 or 3,000 per 1 c.c. These negative results, confirming the classical findings, are the more striking, as the water used proved to be particularly favourable to the multiplication of lactose-fractors. In the case of the Croydon *Salmonella typhi* in autoclaved water, a strictly parallel experiment with a strain of typical *B. coli* showed enormous multiplication, i.e. from hundreds to tens of millions, the organisms surviving for many weeks. Experiments have also been carried out with mussels infected artificially with strains of *Eberthella typhi*, but rapid diminution in numbers always occurred.

Inadequacy of Tests dependent on Incubation at 37° C.

The position as it stands at present is that we may at any time be confronted with a report, based on the ordinary methods of analysis, that our purified mussels are, say, twenty times worse than those described by Houston as "outside the pale of recognition". If we accept the tests in question, we must submit to having the purification tanks condemned as a grossly insanitary area, which should forthwith be permanently closed under the Public Health (Shell-fish) Regulations. Temporary closure would be unsound in theory and impracticable commercially. If the reports in question are ignored, health authorities, both locally and at the markets, are placed in an invidious position. The fact remains, however, that we must ignore them, for it is manifest that, in view of recent findings, there can be no legitimate standard of purity for purified shell-fish based on tests carried out at a temperature of 37° C.

Incubation at 44° C.

What, then, is the solution ? My own view is that a perfectly satisfactory one is to be found in incubation at 44° C., a solution already strongly advocated by G. S. Wilson (1935) and others in the case of milk. For the last two years we have carried out a series of experiments at 40°, 42°, 44°, and 45°, with controls at 37° C. I cannot, of course, enter into any analysis of results now; suffice it to say that at 44° C. all the citrate-positives derived from shell-fish—that is to say, the group comprising the " multipliers " responsible for the anomalous results—are eliminated, whilst the great majority of typical *B. coli* grow. The minority of typicals which do not show up are mostly merely inhibited, and can be recovered later, if desired—the citrate-positives being killed. Some of the intermediate types, which are weakly citrate-positive, grow at 44° C., but this is immaterial. I would deprecate any hair-splitting about the significance of borderland bacteria, and what not. At one time controversy raged around the fæcal significance of the endless series of variations in the fermentation reactions with what are conveniently, if loosely, called the " sugars ". The sum of academic knowledge was doubtless increased, but practical shell-fish issues were merely obscured. Ten years ago I had the temerity to say, in a published paper, that this controversy reminded me of the Schoolmen who argued interminably over the number of angels that could be accommodated on the point of a needle. I hope we may resist any temptation to embark on another " needle " controversy over the fæcal and non-fæcal significance of borderland organisms. Precise knowledge is lacking, and if we do not confine ourselves to broad issues we shall get nowhere.

It is agreed that as matters stand at the moment it is desirable to have a market test for shell-fish. We have carried out a long series of tests at 44° C. with unpurified mussels from numerous polluted sources, with controls at 37° C. The relative counts vary somewhat widely, but, generally speaking, a tightening-up of the criteria of pollution about five times would probably meet the case. A conference amongst those concerned, with the data available at their disposal, would be very helpful.

It is interesting to note that in America similar difficulties have been encountered, leading to adverse criticism of the methods hitherto usually employed in assessing shell-fish pollution. One of these difficulties has been the high " scores " found in shell-fish from beds manifestly topographically clean. It has now been found that such anomalous " scores " have been due to the inclusion of citrobacters, and it has, moreover, been demonstrated that these citrate-positives multiply prodigiously in the shell-fish. There is thus an interesting parallelism between the American findings and ours. The acceptance of *Escherichia coli* only, as an indicator of fæcal pollution of shell-fish, was recently advanced at the Annual Meeting of the Society of American Bacteriologists (December 28, 1937), and incubation at 44° C. or 45° C., for the standard tests was put forward (Perry, 1937).

Conclusions and Recommendations

In conclusion, I may briefly sum up the position as follows : Medical opinion is insistent upon the urgency of the adoption of measures designed, in the interests of public health, adequately to grapple with the present very unsatisfactory shell-fish position. Such opinion has been crystallized from time to time in influential representations—notably in Resolutions passed by the British Medical Association in 1936, and by the Association of Port Sanitary Authorities in 1935 and 1937—urging the adoption of compulsory purification in this country, by an approved method, of all shell-fish, whether home-grown or imported.

It is submitted that, failing a better, the method just described, which is approved by the Ministries of Health and Agriculture and Fisheries, offers a ready means of implementing the Resolutions just referred to, being simple and practically fool-proof in operation and economically sound, and experience extending over nearly a quarter

of a century having provided strong cumulative evidence that it is an adequate safeguard of the Public Health.

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Dr. J. D. Rolleston said that the late Sir William Hamer and another former President of the Section—Sir Arthur Newsholme[2]—had drawn attention to the dangers of shell-fish being contaminated by typhoid bacilli. The prophylactic measures described by Dr. Dodgson accounted for the rarity at the present time in this country of typhoid fever due to shell-fish, and to oysters in particular. This fact was in striking contrast with what occurred in France where "ostréo-typhoïde" as it was called was relatively frequent, and was remarkable for its short incubation period, severity of course, and high fatality. The subject had given rise to a good deal of literature in France, including a monograph entitled "Coquillages et fièvres typhoïdes" by Dr. V. M. Bélin, whose wife, also a medical practitioner, had died from typhoid fever due to consumption of shell-fish.

[2] "Fifty Years in Public Health". 1935, 206-13.

Section of Radiology

President—R. E. ROBERTS, M.D.

[*February* 18, 1938]

DISCUSSION ON DEFORMITIES IN THE REGION OF THE HIP-JOINT

Deformities at the Hip-joint in Children

By C. G. TEALL, M.B.

THE deformities which occur at the hip-joint may be considered under two headings: (1) Those due to congenital abnormalities. (2) Those due to disease.

Before proceeding to consider the abnormalities found in this region it is necessary to bear in mind certain points about the normal appearance of the hip-joint in children. In infants a large portion of the bone at the hip-joint is still in its cartilaginous state, and in the absence of ossification the radiograph shows no direct evidence of the condition of the joint itself. The centre of ossification in the epiphysis of the head of the femur usually appears in the second half of the first year, but no constant date can be given for its appearance, which is subject to wide variations within the limits of the normal; it may appear within the first three months or be delayed until after the first year. As a rule the ossific centre appears in both hips at about the same time and the presence of ossification in one epiphysis and not in the other may give some indication that all is not normal on the side from which it is missing, but it is not absolutely reliable evidence. In all radiographic examinations of the pelvis and hip-joints it is essential, if possible, to have the patient lying quite straight, with the heels and toes together, and this is particularly important in infants, for we have to rely, in judging of displacements at the hip-joint, on the relative positions of the shaft and small ossified portion of the neck of the femur and the pelvis. If the patient is rotated it is quite impossible to recognize such displacements unless they are very gross. In older children it is equally important to position the patient carefully, as the angle of the neck of the femur to the shaft cannot be judged accurately if the femur is rotated. In all cases in children it should be made a rule to make a radiogram showing both hip-joints on one film, except in the case of a series made to watch the progress of disease after a diagnosis has been established. With radiograms made in this way, with the patient correctly positioned and the tube accurately centred, differences between the appearance of the two sides can be seen and a unilateral lesion may be recognized which would otherwise be overlooked.

CONGENITAL DEFORMITIES

There may, of course, be gross congenital deformity in the region of the hip-joint due to absence—more usually partial absence—of the femur, but the only congenital deformity at the hip-joint which is of clinical importance is congenital dislocation.

Congenital dislocation (Fig. 1, Plate I).—This is an extremely important deformity from the radiologist's point of view, inasmuch as success in treatment depends in a great measure on its early recognition. It may be either bilateral or unilateral, the unilateral cases occurring about twice as commonly as the bilateral ones. It exists at birth but as a general rule is not recognized until the child begins to walk. The dislocation may be complete or there may be only a subluxation, and if the displacement is only slight it may easily be overlooked in an infant when only a little of the bone at the upper end of the femur is ossified. Until the ossific centre appears in the head of the femur the most important radiographic sign is the abnormal

shape of the acetabulum, for, whereas normally the upper part of the acetabulum is placed horizontally and makes a buttress which prevents upward movement of the head of the femur, in a case of congenital dislocation this upper portion is much reduced in size or is absent. The acetabular cavity is shallow and comes almost into line with the outer surface of the ilium. When the ossific centre in the femoral head appears, the dislocation is more easily recognized. At birth the femoral head is normal in shape, but since it does not have to bear the body-weight or to withstand the normal stresses which are the result of its position in close apposition to the acetabulum, ossification is delayed, and in unilateral cases a marked difference may be seen in the size of the ossific nucleus on each side. In the absence of the femoral head, the already shallow acetabulum becomes more markedly so by the overgrowth of cartilage and fibrous tissue—a point which may be recognized radiographically by the wide joint space seen after reduction has been effected. In old-standing cases the pressure of the misplaced femoral head may produce a false acetabulum by pressure on the side of the ilium at a higher level ; this may be quite shallow, but in some cases a well-formed socket may result.

In a well-developed case the diagnosis is obvious on radiographic examination but in the early stages the condition may easily be overlooked. Displacement may be negligible until weight-bearing begins, but if present may be recognized by the break in the normal continuous curve from the neck of the femur to the pubic ramus. At a later stage the delayed ossification of the ossific nucleus will offer a further clue in unilateral cases.

During the course of treatment the radiologist is called upon to decide whether the dislocation has been reduced or not, and in this connexion it is important to be on the watch for fractures in the upper extremity of the femur and, since the limb will be in plaster, good radiograms are essential if fractures are to be recognized. These are especially liable to occur in patients who, having had their limbs in plaster for some time without reduction of the dislocation, are subjected to a further attempt at reduction.

The results of treatment vary considerably. Many cases which at the time of treatment are apparently satisfactorily reduced give disappointing results. The fact that the acetabulum does not develop normally after the femoral head has been replaced may defeat all attempts at reduction, and the femoral head may have been subjected to such a degree of trauma during the course of treatment that its growth is impaired and it does not develop normally with the result that in old-standing cases it is difficult to tell from a radiographic examination if the case is one of an old reduced congenital dislocation or of old osteochondritis.

Deformities Due to Disease

Tuberculous disease.—Of the deformities due to disease, tuberculous disease at the hip-joint is the most important, and apart from tuberculous caries of the spine, it is also the most important type of tuberculous disease affecting the bones. While radiography plays a most important part both at the time of the diagnosis of the condition —especially in the differential diagnosis—and also later during the course of treatment to watch progress, it must be borne in mind that in an early case in which clinical signs of disease at the hip-joint are quite definite a radiogram may show no sign whatever of any abnormality. The earliest radiographic sign of the disease is a generalized rarefaction of the bones in the region of the hip-joint (Fig. 2, Plate I). At first this will not be at all marked and will certainly be overlooked unless radiograms are made to include both hip-joints on the same film for purposes of comparison. In a certain number of cases the disease may run its course without producing any sign of a focal lesion in the bone which can be recognized radiographically, but such cases are not common.

As a general rule signs of the presence of a primary focus of disease in the bone

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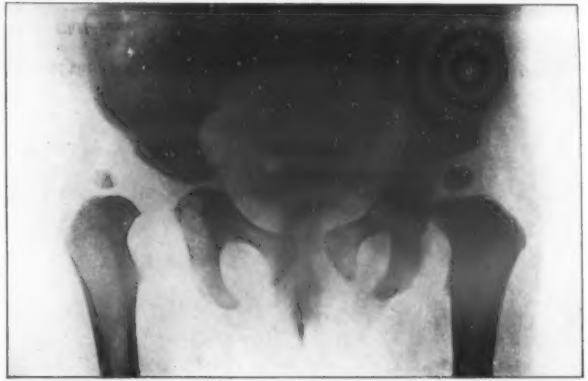

1.—Congenital dislocation at the hip-joint. Note the absence of development of the acetabulum and the small size of the epiphysis of the femoral head on the affected side.

2.—Early tuberculosis of the hip-joint showing the generalized rarefaction of the bones but no focal bone lesion.

3.—Tuberculosis at the hip-joint with extensive bone destruction.

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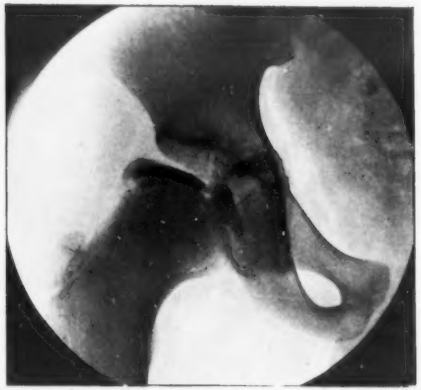
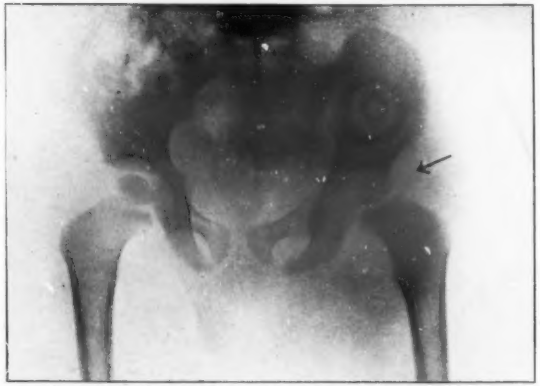
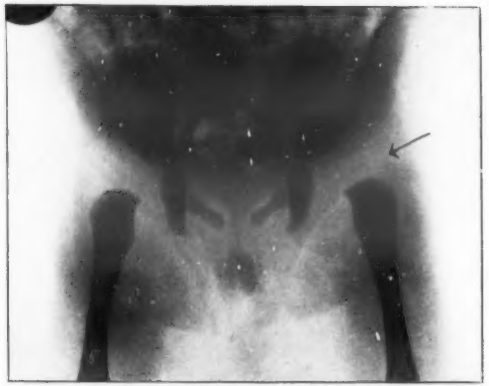


4.—Osteochondritis deformans juvenilis coxæ, showing flattening, fragmentation and sclerosis of the femoral head and the typical appearance in the metaphysis adjacent to it.



5.—Acute infective arthritis with erosion of the joint surfaces.



6.—Acute infantile arthritis showing dislocation at the hip-joint.

are not long delayed. Most commonly this primary focus appears in the head or neck of the femur, and next in order of frequency in the acetabulum. In some cases, however, the disease may commence in the synovial membrane. When the focus first appears it is recognized as a localized area in the bone in which the trabeculæ become ill-defined and soon disappear in an irregular manner, producing first a mottled decalcified area and later an area of complete bone destruction (fig. 3, Plate I). There is considerable variation in the rate at which such a focus develops. In severe cases it may be extremely rapid so that in a short time there is a marked degree of bone destruction, and a large portion or even the whole of the head and neck of the femur may disappear completely, with corresponding rapid destruction of the acetabulum. In most cases, however, progress is much less rapid, even though there may ultimately be considerable bone destruction. Of the cases where the primary focus is in the femoral neck, in a few the lesion may remain localized without involving the joint structure, but as a rule whether the primary focus is in the head or neck of the femur, or in the acetabulum, the joint is involved at an early stage of the disease.

During the course of treatment the radiologist is called upon to demonstrate the condition of affairs at the joint and to show whether the bone destruction is still spreading, when it becomes arrested, and when improvement occurs. Improvement will be recognized by recalcification in the diseased area which increases until eventually the bone which remains becomes consolidated. In the ordinary way unless the disease has been arrested at a very early stage, one cannot hope to see anything approximating to a normal appearance at the hip-joint, which almost invariably has become completely disorganized. The best result which can be hoped for in most cases is a sound bony ankylosis at the hip-joint, and if this can be secured in good position it may be regarded as extremely satisfactory.

Osteochondritis deformans juvenilis coxæ.—(Fig. 4, Plate II). This condition is known by a number of different names—coxa plana, pseudocoxalgia, Perthes', Legg's, or Calvé's disease and—although I must confess to referring to it as Perthes' disease—in view of the plea I have made previously in this Section for clarifying the nomenclature of the bone dyscrasias in children, I use the longer name here, because it is the one based on the pathology of the condition, which is an osteochondritis analogous to the other types of osteochondritis deformans juvenilis.

A whole series of causes have been suggested to account for its occurrence. Injury, endocrine disturbance, interference with the blood supply to the epiphysis, mild chronic infection, and a number of other causes have been put forward, but none of them is conclusive and it must therefore be accepted at the present time that the cause is unknown. For some reason it is much more common in boys than in girls, and I myself have seen only one case in a female patient. It usually occurs in children from about 5–10 years of age, and attention is first drawn to the abnormal condition at the hip-joint by the fact that the child limps. Originally it was not differentiated from tuberculous disease at the hip-joint and it is one of the conditions which owes its recognition as a separate entity to radiography. It is interesting to note, however, that one of my old teachers, the late Professor Jordan Lloyd, recognized it before it was discovered by X-rays. He used to tell us :—

> "There is a kind of tuberculous hip in which flexion and extension remain free; this variety invariably recovers whatever the treatment, and it never gives rise to abscess formation."

He had a great faculty for describing concisely the clinical features of a disease and in those few words one has an extremely good description of the condition. In these days the radiogram settles the diagnosis.

In the early stages the epiphysis at the head of the femur becomes flattened and more dense than normal. Then its base becomes irregular and areas of lessened density appear in the metaphysis adjacent to it, giving an appearance suggestive of small cavities. The density of the epiphysis gradually increases and it has the appearance of being compressed. The weakened diaphysis becomes broader, and as

the condition progresses the dense flattened epiphysis becomes fragmented and spreads out over the much-widened femoral neck, producing a gross deformity of the upper extremity of the femur. The acetabulum usually remains intact and its outer margin produces still further deformity by pressing into the femoral head, which will no longer fit into the acetabular cavity. This stage of the disease lasts for a year or two and then recalcification commences. The much-broadened head of the femur becomes consolidated and acetabular moulding occurs to accommodate it. The whole series of events usually spreads over about four years, and in spite of the resultant deformity the patient may ultimately have a fair range of movement. As is to be expected, however, with a joint so much deformed, arthritic changes are likely to develop at a later date.

Acute infective arthritis.—This condition occurs most commonly as a secondary infective focus from sepsis elsewhere and is usually due to either a streptococcal or a pneumococcal infection. It is one of the complications of the specific fevers, especially scarlet fever.

In a case of acute infective arthritis of the hip-joint, radiographic evidence will vary according to the severity of the lesion. If the joint is much distended, in addition to widening of the joint space there may be either subluxation or complete dislocation at the joint; the joint surfaces of the bones become eroded (Fig. 5, Plate II) and varying degrees of bone destruction occur. The femoral epiphysis may become separated and be completely destroyed. As would be expected, therefore, the whole joint is frequently completely disorganized and, ultimately, bony ankylosis takes place.

Acute arthritis of infants is essentially an epiphysitis with secondary involvement of the joint. The hip-joint is the one most commonly affected. Evidence of subluxation or complete dislocation is found on radiographic examination (Fig. 6, Plate II) and complete destruction of the epiphysis usually occurs. As opposed to acute infective arthritis in older children, ankylosis is not commonly found as a sequel to this condition, but if recovery takes place—and the mortality is high—the end-result may easily be mistaken for an old congenital dislocation at the hip-joint.

Syphilis.—Congenital syphilis may affect the hip-joint in common with other joints. The bone lesions in this disease are of three types: (1) Osteochondritis; (2) osteomyelitis; (3) periostitis; but the one which commonly occurs in the region of the epiphysis is the osteochondritis type of lesion. The lesions vary greatly in severity. There may be only slight rarefaction at either side of the epiphyseal line or there may be gross bone destruction. The so-called epiphyseal separation which occurs in congenital syphilis is really, as in scurvy, a fracture through the weakened metaphysis.

Coxa vara.—This is the name applied to a condition in which the normal angle between the neck and the shaft of the femur is reduced. In children this should be about 160 degrees, but in coxa vara it may become less than a right angle. The deformity is produced mechanically by the weight of the body acting on the neck of the femur when this has been weakened from any cause. Coxa vara may be produced in children by a number of causes which may be divided into three main groups: (1) Infantile coxa vara (Fig. 7, Plate III); (2) coxa vara occurring in patients suffering from bone diseases in which the neck of the femur is softened and unable to withstand the normal strain of the body-weight; and (3) coxa vara which occurs as a result of slipping of the femoral epiphysis.

The infantile type: Apart from the fact that this condition constitutes a clinical entity it would probably more properly be included with those cases due to bone disease softening the neck of the femur, for all these cases show an abnormal ossification in the neck of the femur which appears to be in the nature of an osteochondritis. The affected area in the neck cannot withstand the normal stresses imposed upon it and gives way, producing a marked coxa vara deformity. It is usually bilateral but the amount of deformity is not necessarily or usually symmetrical.

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7.—Infantile coxa vara.

8.—Coxa vara in dyschondroplasia (Morquio-Brailsford type).

9.—Coxa vara in achondroplasia.

10.—Slipping of the femoral epiphysis—adolescent type.

PLATE IV.

11.—Slipped epiphysis in osteomyelitis of the neck of the femur. Note complete dislocation of epiphysis with femoral neck impinging upon the acetabulum.

13.—Coxa valga in progeria.

12.—Slipped femoral epiphysis in renal rickets.

Coxa vara due to general bone disease : In general bone diseases in which either the bones as a whole are softened or their metaphyseal portions become weakened, it is only to be expected that the neck of the femur, which has to withstand the weight of the body, will bend under the strain, producing a condition of coxa vara. Such a deformity is produced in children in a number of diseases, notably rickets. Radiograms in such a case will, of course, show other rachitic deformities in addition to coxa vara. Similarly, in dyschondroplasia, the abnormal development of the bone ends, with irregular ossification and cartilage formation, produces a weakened abnormally-developed neck and upper extremity of the femur, and coxa vara may develop. This may occur in various types of dyschondroplasia, but notably in the one described by Morquio and Brailsford, in which the changes are confined to certain of the vertebral bodies and to the hip-joints (Fig. 8, Plate III). Coxa vara may also develop in achondroplasia (Fig. 9, Plate III).

In localized diseases of bone when the upper extremity of the femur is involved coxa vara may, of course, occur, for it must be remembered that coxa vara is merely the name of a type of deformity irrespective of the pathological condition which produces it. It may, therefore, be found as an after-result in cases of tuberculous disease at the hip-joint, osteochondritis juvenilis, or osteomyelitis of the neck of the femur.

Coxa vara due to slipping of the femoral epiphysis : This is the adolescent type of coxa vara and occurs in children from about 10–15 years of age. The exact nature of the cause of this condition is not fully understood, but there appears to be a consensus of opinion that it is never purely traumatic. Certainly in my experience a traumatic separation of the upper femoral epiphysis analogous to separation of the radial or other epiphyses does not occur. It seems probable that an abnormality, presumably an osteochondritis, occurs at the epiphyseal cartilage, and then a superadded trauma, which normally would produce no untoward result, is sufficient to cause the epiphysis to slip.

On radiographic examination of this condition one finds varying degrees of deformity, from slight slipping to gross displacement of the epiphysis in which the head of the femur is displaced so far downwards that the upper end of the diaphysis comes to rest against the acetabulum. The epiphysis shows no signs of disease and is clearly defined, but the end of the diaphysis may not be so clear-cut and lends weight to the suggestion of some pathological change at the epiphyseal junction. If the condition is recognized at an early stage and the deformity is reduced, a reasonably good functional result may be obtained, but in the absence of adequate treatment gross deformity results and necessitates osteotomy.

In addition to the adolescent type of slipping of the femoral epiphysis (Fig. 10, Plate III), the epiphysis may become separated as the result of definite disease affecting the bone at the epiphyseal junction. Such separation may occur in cases of osteomyelitis of the neck of the femur (Fig. 11, Plate IV), in septic arthritis and in renal rickets (Fig. 12, Plate IV).

Coxa valga is the name given to the deformity in which the normal angle between the neck and shaft of the femur is greater than normal. It occurs in patients in whom for various reasons one or both legs have not borne the weight of the body, quite apart from the pathological condition which brings this about. Thus I am able to illustrate a condition of coxa valga in such widely different conditions as unreduced congenital dislocation at the hip-joint, progeria (Fig. 13, Plate IV), and fragilitas ossium. It is, of course, much less commonly seen than coxa vara.

These then are the conditions which commonly produce deformity at the hip-joint in children. In the short time at my disposal I have not been able to do more than refer to them briefly, for any one of them might quite well provide material for an evening's discussion. There are, of course, others than those I have mentioned, but I have confined myself to those which have occurred with considerable frequency in the course of my work at the Children's Hospital, Birmingham.

Hip Deformities in Adults

By F. Campbell Golding, M.B.

The deformities of the hip which the radiologist sees in adult life may be the result of congenital or adolescent dyscrasia or disease, or may be recently acquired.

Amongst the common deformities, which the child carries into adult life, are those associated with congenital dislocation, pseudo-coxalgia, and slipped epiphysis. In any series of osteo-arthritic hips, a certain proportion are found to have this condition engrafted on one of these deformities. Or, looked at from the other aspect, it is difficult to imagine a hip-joint with any marked deformity escaping osteo-arthritis in later life. This is, no doubt, the distorted perspective of the radiologist, as he sees only those cases which give rise to symptoms.

Congenital dislocation of the hip (fig. 1, Plate I).—This is a deformity of the acetabulum and in the radiogram shown it is seen that in spite of the youth of the patient, osteo-arthritic changes are taking place.

Slipped epiphysis.—Fig. 2, Plate I, shows a deformity of the femoral head. It is a slipped epiphysis with a varoid neck. The surgeon has attempted to correct the deformity by an osteotomy, in spite of the abduction which has been produced, the neck is still forced to bear weight, with the inevitable result that osteo-arthritic changes are again occurring at an early age. In other words, any deformity of the hip is liable to put the age incidence of osteo-arthritis forwards by twenty or thirty years.

Infective conditions: Tuberculosis.—It is natural to begin with tuberculosis, as this disease is so common in routine orthopædic work (*see* Table I).

Table I.—Total Number of Cases of Tuberculosis—840.

Spine	271	Hand	21
Hip	270	Elbow	14
Knee	146	Shoulder	14
Foot and Tarsus	42	Sacro-iliac	13
Ankle	40	Wrist	9

Of 270 patients seen at the Royal National Orthopædic Hospital with hip disease, the age incidence was at a maximum between 3 and 7 years and, after 7 years declined progressively (*see* Table II, p. 43).

Tuberculosis of the hip is, therefore, not very common in the adult. One is, however, frequently presented with a film showing a pathological change and asked: "Has this been a tuberculous joint in infancy?" There are certain points on which an opinion may be formed:—

(1) Healing of a tuberculous joint, especially by bony ankylosis, is a slow and imperfect process. If, therefore, ankylosis is complete and perfect, it is unlikely that the condition was tuberculosis, excluding the cases which have been secondarily infected and those operated upon.

(2) Tuberculosis causes an alteration in cancellous structure. Trabeculation becomes more dense and more widely spaced. I have also noticed that the joint below the seat of disease is affected in a similar fashion.

(3) Tuberculosis tends to leave behind it small, irregular, dense, homogeneous deposits of calcium in the region of the joint-space. These appear to persist indefinitely.

Tuberculosis does not always begin in synovial membrane or subchondral bone. It may commence in neighbouring bone and extend into the joint. Examples of this are the metaphyseal focus and the ischial deposit. These lesions have to be differentiated from osteomyelitis, and the metaphyseal lesion also, from a cyst.

Gonococcal infection.—Fig. 3, Plate I shows the result of a gonococcal hip. At first sight it resembles a coxa plana but the patient was 25 years old, he had no previous deformity, he was, in fact, a professional footballer, and the changes followed a gonococcal infection at the eighth week.

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PLATE I.

FIG. 1.—Congenital dislocation of hip.

FIG. 2.—Slipped epiphysis.

FIG. 3.—Gonococcal hip.

F. CAMPBELL GOLDING: Hip Deformities in Adults.

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PLATE II.

FIG. 4.—Spontaneous fracture of the hip in a case of Charcot's disease.

FIG. 5.—Late result of a dislocation which was reduced. Note deposits of bone in the soft tissues round the joint.

F. CAMPBELL GOLDING: Hip Deformities in Adults.

TABLE II.—AGE AND SEX INCIDENCE IN DISEASES OF THE HIP.

Age when first treated	Male	Female
Under 1	1	—
1	2	1
2	6	3
3	14	7
4	13	11
5	12	9
6	17	11
7	12	10
8	8	7
9	9	5
10	12	5
11	10	5
12	3	4
13	7	7
14	5	5
15	1	6
16	2	2
17	1	2
18	—	3
19	—	1
20	—	4
21	—	2
22	1	1
23	1	1
24	—	1
27	2	—
29	—	2
31	—	1
33	—	2
34	—	1
35	1	—
37	—	2
40	—	1
41	—	2
42	1	—
45	—	2
50	—	1
54	—	1
59	—	1
	141	129

After the age of 14 years, the sex incidence alters as shown.

The diagnosis of a gonococcal joint is very difficult, as there do not appear to be pathognomonic features or characteristic points upon which one can entirely rely in all cases.

Charcot's disease.—The diagnosis of a Charcot's joint is usually fairly obvious. It is uncommon to see the early stages of the condition in an X-ray department, as the onset is usually insidious. Sometimes the early stages may be found by radiographing other joints, which appear to be symptomless, in a frank case of this disease.

The proportion of patients who develop this condition is about 2–4% of syphilitics and the hip-joint is usually third in the order of frequency, being preceded by the knee and ankle or foot.

Spontaneous fracture is sometimes an early symptom of Charcot's disease. Fig. 4, Plate II shows an unusual example of a spontaneous fracture in the hip with development of excess bone.

The radiologist should not alter his diagnosis because the Wassermann reaction is negative ; this has been my experience in 50% of cases.

A joint may show both atrophic and hypertrophic features. A patient presented himself for treatment at hospital with bilateral Charcot's joints, atrophic on one side and hypertrophic on the other. He stated that his occupation was that of a tight-rope walker.

Trauma.—After an injury, the radiologist is largely concerned with the question of deformity produced and the degree of union. He is also expected to provide

excellent films of the lateral view, irrespective of the size of the patient and the wealth of apparatus in which the limb is held. It is depressing to be confronted by a heavy patient lying in the concavity of a bed and, when viewed from the feet, the hip does not appear above the skyline.

Fig. 5, Plate II shows the unfortunate late result of a dislocation which was reduced. There are multiple deposits of bone in soft tissues round the joint.

Tumours.—Tumours of the hip bear no special features. The exostoses cysts and the chondromas are the same as elsewhere. One case of multiple chondromatoses is of some interest as it has been followed over many years. This patient had over 150 loose bodies in the hip-joint ; they were removed but are now forming again, in spite of the fact that a large part of the synovial membrane was excised.

Protrusio acetabuli.—Acetabular protrusion depends only on a malacic process in the acetabulum. It is associated with many disease processes. These may be subdivided in many ways. One convenient classification is :—

(1) Any destructive disease, which by chance happens to involve this site, e.g. tuberculosis, syphilis, Paget's disease, sepsis, neoplasm, or echinococcal disease of bone.

(2) The rheumatic group : Non-specific infections, rheumatoid arthritis, gonococcal disease—if you care to put this under this heading—and osteo-arthritis, although I believe this is always a secondary process.

(3) A peculiar group, the ætiology of which is unknown. The characteristic features are a very thin wall of the acetabulum and an intact cartilage, into which the head is buried to a varying extent. The acetabulum may be so deep that a facet forms by contact of the lesser trochanter and ischium. It appears to me that this condition arises in early life. I know that trauma is considered to be the main ætiological factor in most cases. In 23 cases I thought that any trauma which the patient mentioned was the exciting cause for treatment rather than the origin of the process. Once the condition has developed, it does not appear to increase. Mr. Jenner Verrall published a case of this disease in 1929,[1] the extent of the protrusion in this patient is still the same but she is developing osteo-arthritis.

Rheumatoid arthritis does not appear to be very common in the hip—or, alternatively, it may be that in a disease which is so frequently generalized, the clinician is content with the radiograph of a smaller joint. The main points are : (i) Loss of cartilage—even loss of joint space. (ii) Sub-chondral changes—generally distributed. (iii) Decalcification of senile type. (iv) General lack of outstanding features and great similarity in appearances in all cases.

Osteo-arthritis : The radiological aspect of osteo-arthritis is practically a dead subject—in contrast to the recent surgical adventures. Apart from the salient features of loss of cartilage at the weight-bearing point, local sclerosis of bone, and new bone formation, cavitation of bone is one of the most persistent findings and may even be the earliest evidence of osteo-arthritis ; another feature is that the head tends to move out of the acetabulum, and a third point is that new bone forms in the acetabulum.

In a series of 300 patients with this condition, cavitation was present in 91%. The head was moving outwards in 53%, and there was evidence of acetabular bone in 39%. I have heard arguments waged on the point. Does the head move out because it is pushed out by this formation of bone ? or does the head move out and the bone form secondarily ? These percentage figures suggest the latter theory. In any case, this bone is formed in the acetabulum, but not as its name implies, from the acetabulum. It is deposited on the femoral head.

[1] Verrall, P. Jenner (1929), *J. Bone and Joint Surg.*, **11**, 39.

Section of Ophthalmology

President—W. H. McMullen, O.B.E., F.R.C.S.

Meeting at the Birmingham and Midland Eye Hospital on February 11, 1938

Chronic Sympathetic Ophthalmitis.—T. Harrison Butler, M.D.

The patient is a girl, aged 18.

History.—In November 1925 the left eye sustained a slight wound at the limbus, and a small button of iris prolapsed. An attempt was made to remove the prolapse. There is some doubt as to the exact nature of the accident, but the mother thought that it was due to a flick with a whip by the brother. A fortnight later K.P. were noted and the slit-lamp showed that the anterior chamber was choked with cells; a slimy deposit was seen on the posterior surface of the cornea, and fine synechiæ were detected. At the same time cells were seen in the anterior chamber of the right eye. The left eye was removed nineteen days after the attempt to remove the prolapse, which had been made a fortnight after the accident. A year later the right eye showed no K.P. and no cells in the aqueous; up to this time there had always been a few deposits of fine pellucid K.P. There was some diffuse choroiditis, the whole fundus being peppered with fine pigment. The vision has never fallen below $\frac{6}{6}$. A year later there was again some K.P. and there were fine particles circulating in the anterior chamber. The vitreous was still infiltrated with small, sharply defined particles. There were cells in the retro-lental space. Several courses of novarsenobillon were given.

An interesting point is that when the cells in the anterior chamber were at rest they began to circulate after an injection of novarsenobillon. This was noted several times.

Subsequent history.—There has never been any injection of the eye. From time to time, about every three months, I have examined it with the slit-lamp and always there have been a few deposits of pellucid K.P. They are not the same spots; I have made careful observations and find that the old deposits absorb and new ones appear. The vision is $\frac{6}{5}$, and apart from the K.P. the eye is normal.

I consider that the girl is still, after twelve years, suffering from the original sympathetic ophthalmitis.

The President said that in a similar case he had excised the eye some eighteen days after the injury. Three or four days later the patient, a young boy, had complained of mistiness of vision in the other eye and was found to have profuse K.P. This disappeared under treatment with novarsenobillon. K.P. recurred from time to time for some years afterwards. Any return of the trouble had always cleared up under this treatment. At one period the patient had become unduly sensitive to the drug and then the K.P. had lasted for a longer time. He (the President) had not seen him now for several years.

Irregular Thinning of the Corneæ.—T. Harrison Butler, M.D.

The patient, a man aged 55, had, in October 1933, a corrected vision of $\frac{6}{1\frac{2}{2}}$ in both eyes. In February 1934 he underwent a mastoid operation, and for some years he has had arthritis of the cervical spine. In October 1937 he found that his sight was failing, and when he came to the West Bromwich Hospital his vision was less than $\frac{6}{60}$ in the right eye and $\frac{6}{24}$ in the left. The cause of this rapid deterioration is irregular thinning of the cornea. I have never before seen such a rapid change in the cornea and I wonder whether it is due to the mastoid disease.

Tumour of the Optic Nerve.—E. B. ALABASTER, L.R.C.P., M.R.C.S., D.O.

This patient came to hospital on October 14, 1937, complaining of frontal headaches and of poor vision in the right eye. The acuity of the right eye was only $\frac{6}{18}$, while that of the left was $\frac{6}{6}$. There was some exophthalmos of the right eye—21 mm. as against 15 mm. in the left. The fundus presented some pallor of the disc. The movements were normal. The sinuses were examined by X-rays and found to be normal.

The case was referred to Dr. J. Bromley at the General Hospital, for treatment by deep X-rays, but as there was no response after a few applications this was discontinued. By December 2 the exophthalmos had increased $\frac{1}{2}$ mm., and when the patient was seen by Dr. Thompson on January 3 no sign of Graves' disease was present. The question of excision naturally arises, and the opinion of members is solicited.

Discussion.—Mr. M. H. WHITING asked what was the vision in the eye with the optic nerve tumour. [Mr. ALABASTER: $\frac{6}{18}$, when the patient was first seen.] Might it not be worth while to expose the optic nerve; turn the eye forward, perhaps by dividing the external rectus, and discover the exact nature of the tumour. In a case recently reported at the Royal London Ophthalmic Hospital, Mr. Stallard had removed an angioma from around the optic nerve, and the patient had recovered and had quite good vision.

Mr. LINDSAY REA said that it was necessary to have comparative skiagrams of the two optic canals. Undoubtedly it was the enlargement of the optic canals that had led to the posterior operation being performed.

He had known of three cases of glaucoma brought on by treating a tumour in that region with radium.

Uveo-parotid Fever.—CHARLES RUDD, M.B., Ch.B., D.O.M.S.

The patient, a boy aged 14, first attended hospital in April 1937 suffering from bilateral iridocyclitis.

Family history.—The patient's father was in a sanatorium for about two months some time ago, and again at the end of last year, so that there is a family tendency to tuberculosis.

The Wassermann reaction was negative, the Mantoux slightly positive. Skiagrams of sinuses and teeth showed no infection. About a month after admission, both parotid glands became enlarged and firm, but not markedly tender. The patient was transferred to the Fever Hospital as a doubtful case of mumps; later he was discharged and attended the Queen's Hospital. The parotid glands were still enlarged, but there was no enlargement of either of the other salivary glands or of the lachrymal glands, and this precluded a diagnosis of Mikulicz's disease. Finally a diagnosis of uveo-parotid fever was made.

The ocular condition has now all the appearances of a tuberculous iridocyclitis. Removal of a piece of the enlarged parotid gland was considered, but was not carried out, on account of the risk of fistula. The parotids were treated by X-rays, and, after some weeks, slowly returned to normal. Tuberculin injections are being given.

Discussion.—Mr. G. F. HAYCRAFT said that he had recently seen a case of uveo-parotitis, in which there had been a swelling of one parotid. Later a swelling had appeared in the other parotid. The parotid condition seemed to return to normal without any particular treatment at all. He had had the patient examined by various people without discovering any constitutional cause. He wondered whether it was true that this was a tuberculous condition, because it was nine months since he had first seen this patient, and she still had what he would call tuberculous iridocyclitis.

Mr. FRANK JULER said that he had seen three cases during the last year or two and had some knowledge of three others. Possibly not all these cases were tuberculous, but there was a strong probability that nearly all of them were, and he believed that the proper treatment was to follow the same lines as if they were cases of pulmonary tuberculosis.

Mr. RUDD (in reply) said that a skiagram of the chest showed the lungs to be normal, but there were enlarged mediastinal glands. He was treating it as a tuberculous case.

Bilateral Proptosis with Craniopharyngioma.—CHARLES RUDD, M.B., Ch.B., D.O.M.S.

This patient attended hospital, not because of any defect of sight, but because of the proptosis and on account of his appearance. Actually his vision is $\frac{6}{6}$ in each eye. There are no changes in the fundi. The fields of vision, taken on the Bjerrum's screen, show only very slight temporal loss in each eye. The proptosis began in the right eye and has slowly increased in both eyes since it was first noticed about fifteen years ago. A skiagram of the skull shows a greatly enlarged sella, with a depression, apparently congenital, in the posterior part of its floor. The blood has been examined and is normal, and the Wassermann reaction is negative. The possibility of hyperthyroidism was considered but the basal metabolic rate was ascertained and found to be normal.

The suggested explanation of the proptosis and the chronic œdema of the lids is that there is lateral pressure on the cavernous sinuses from an intrasellar craniopharyngioma—leading to a very slow obstruction.

The neurological surgeon advises operation if any marked increase in the defect in the fields of vision is found when the patient is re-examined.

Mr. LINDSAY REA said that he had had a case in which both eyes were proptosed. The patient was quite blind and both optic nerves were atrophied. The differential diagnosis between this condition and Mr. Rudd's case was demonstrated by X-rays. In Mr. Rudd's case the anterior wall of the pituitary fossa was a strong bony plate, whereas in his (the speaker's) case the anterior wall had been completely eroded owing to a pituitary tumour. The danger of the operation had been emphasized by Martin and Cushing, who had described these early cases, but in more recent times Cairns and others had worked on similar cases and their results—owing to improvement in technique—were devoid of the hyperpyrexia which had been thought must inevitably follow such an operation.

Lexer's Operation for Ptosis.—CHARLES RUDD, M.B., Ch.B., D.O.M.S.

At the Birmingham and Midland Eye Hospital this operation is now performed almost to the exclusion of every other operation for ptosis. As the eye is left practically closed, the risk of corneal ulceration—present in most operations in which the lid is so much raised as to expose the cornea—is avoided. The full effect of the operation is only seen after a month or so, the slow contraction of the strips of fascia in the lid, gradually raising the lid into position. The results, on the whole, are extremely satisfactory, and practically no risks are involved.

Demonstration of a Hereditary Form of Retinal Degeneration in the Rat, associated with Cataract.—By M. C. BOURNE, D. R. CAMPBELL, and K. TANSLEY.

A demonstration was given—with a preliminary account—of a hereditary form of retinal degeneration in the rat associated with cataract. The lesion was illustrated by photographs and by the actual microscopic sections.

The firm of Messrs. Bemax presented the authors with some white and fawn rats of normal healthy stock which were found to have cataract. On breeding several generations of the animals the cataract was found to be always associated with a certain type of retinal degeneration which was inherited as a Mendelian recessive character. The retinal degeneration was often present up to a late stage without any lesion in the lens, so that it was difficult to establish the exact relationship between the development of the two conditions. The cataract developed as a group of dot-like opacities in the posterior cortex and a shadowy ring round the nucleus, which could be seen ophthalmoscopically. Later, the whole lens became opaque. Histological evidence showed that the anterior capsule became much thickened, while the posterior capsule was always very thin and disrupted at the point of maturation of the cataract.

The course of the development of the retinal degeneration was traced by means

of careful histological examination. The retina developed normally for seventeen days and then showed the following changes, in the sequence indicated :—

(1) The disintegration of rods and cones, the rods being lost before the cones.

(2) The loss of the outer nuclear layer and of the external limiting membrane.

(3) The disintegration of the inner nuclear layer and the indrawing of the pigment epithelium.

(4) The convolution of the retina by ingrowing strands and the overgrowth of glial fibres.

(5) The whorling and scattering of the cells of the inner nuclear layer and atrophy of the ganglion cells.

(6) The dissolution of nervous elements, development of mature cataract with fibrosis inside the lens capsule and in the region of the posterior angle, and intra-ocular hæmorrhages.

The lesion thus appeared to be a progressive degeneration of neuro-epithelium. The ciliary body and iris were normal throughout and the blood-vessels of the choroid were unchanged until a late stage, when their walls showed a hyaline degeneration.

Attention was drawn to the striking similarity between the sections of this retinal degeneration and those published by Verhoeff from a case of human retinitis pigmentosa. It was suggested that this lesion in rats was evidence in favour of the argument put forward by Treacher Collins, Verhoeff, and others, that the essential lesion in retinitis pigmentosa is a primary degeneration of neuro-epithelium rather than a disease of the choroidal vessels.

The following cases were shown :—

By T. HARRISON BUTLER, M.D.

Coats' Disease.

By W. H. FULFORD EALES, M.B.

Eales' Disease.

By E. B. ALABASTER, L.R.C.P., M.R.C.S., D.O.

A Series of Cases showing the result of a Splint in Operations for Squint.

By R. D. WEEDON BUTLER, L.R.C.P., M.R.C.S., D.O.M.S.

(1) Distichiasis in Father and Son.

(2) Tumour of Orbit treated by Deep X-rays.

(3) Pedicle Graft for Rodent Ulcer.

By J. JAMESON EVANS, F.R.C.S.

(1) Congenital Fold of the Retina in Two Sisters.

(2) Corneal Degeneration. (? Fatty).

(3) Three Cases of Transconjunctival Myectomy of the Inferior Oblique. (Method described by Chavasse at the Ophthalmological Congress held in Oxford, July, 1937.)

(4) Two Cases of X-ray Cataract.

(5) Paralytic Squint : Combination of Operative and Orthoptic Treatment.

(6) Secondary Carcinoma of Choroid : Radon Treatment.

By G. S. HALL, M.B.

Polyneuritis with Multiple Cranial Involvement.

Section of Orthopædics

President—A. Rocyn Jones, F.R.C.S.

[*April 5*, 1938]

DISCUSSION ON THE TREATMENT OF TUBERCULOSIS OF THE HIP AND SPINE IN ADULTS

Treatment of Tuberculosis of the Hip

By H. J. A. Colvin, M.B., Ch.B.

At the present time the treatment of tuberculosis of the hip in adults presents certain features which have been gradually evolved and which, more or less in combination, are able to give a reasonably good prospect of sound healing.

The important developments are as follows :—

(1) The conception that a focus of tuberculosis—in the hip or elsewhere—is the manifestation of a serious constitutional disorder has promoted a duality of purpose in our therapeutic attack, namely, (*a*) constitutional, and (*b*) local treatment.

(2) In the constitutional treatment, certain principles have been accepted as fundamental. The value of rest, fresh air, sunlight, and a balanced diet, is undeniable.

(3) Modern local treatment demands the enforcement of strict, complete—and prolonged—immobilization in the active stages of the disease, during which ambulatory forms of treatment cannot now be given a place.

(4) The creation of and developments in bone-graft surgery have followed the almost complete abandonment of radical methods aiming at extirpation of the disease focus (during the stage of evolution at least).

(5) In the furtherance of the twofold purpose of treatment, open-air hospitals have been established for adult patients where the principles of constitutional treatment can most effectively be carried out at the same time as the local therapeutic measures.

It does not seem necessary to make more than a brief reference to the constitutional aspect of treatment. Its value has been more generally recognized as its merits have become increasingly manifest. I should like to stress the advisability of offering to our patients an opportunity of receiving constitutional treatment at the earliest possible moment. I cannot accept the view that adequate constitutional treatment is available in a general hospital.

Whatever may be the attitude to operative intervention, it is not advisable to regard operation, in uncomplicated cases of tuberculosis of the hip, as a matter of urgency. I regard a thorough and complete preparation, combining general with local treatment, as an essential preliminary to operation, whereby the prospects of a successful outcome will be materially improved.

Constitutional treatment must be closely linked with effective local control of the disease focus. Imperfections in the local treatment are not counterbalanced even by superlative constitutional measures ; this combination is as unfortunate and as futile as the application of effective local treatment without adequate constitutional treatment.

In the local management of tuberculosis of the hip in adults I regard the position to-day as being fundamentally the application of constitutional and local non-operative methods over a period of time (which may be short or long according to individual preference), together with operative measures which have been introduced, not as a substitute for conservative treatment, but rather as a means of accelerating in some cases, or supplementing in others, the long, costly, and often uncertain, conservative régime.

In the local non-operative treatment there are two essentials: (1) Recumbency during the active stages to avoid mechanical destruction produced by weight-bearing. (2) Immobilization by adequate splinting to provide local rest and to prevent the harmful effects of joint movement. My personal preference is to use, in the early stages of treatment, an abduction frame, for two reasons: (1) Because it allows of the application to the patient's body of the beneficial effects of sun-rays and moving currents of air, and (2) because it allows examination of the affected hip, which is valuable in facilitating the recognition at an early stage of any complications and, in particular, of the development of tuberculous abscess.

Combined with immobilization, traction may be used to relieve muscle spasm and to prevent deformity and subluxation, with the additional hope that separation of the joint surfaces will minimize the bone destruction due to mechanical compression. In general terms a final position of 35° flexion and 10° abduction may be regarded as the best compromise for an ankylosed hip in adults. As the tendency is for flexion to increase and abduction to decrease during treatment, I maintain in the early stages of treatment a position of somewhat less flexion and slightly more abduction than the above. Modifications in the amount of flexion may be demanded by individual requirements of occupation or for other reasons.

When it is apparent that bone destruction has ceased and when the healing process has become established, I prefer in the ordinary case to replace the abduction frame by plaster. Occasionally—but very rarely in my experience—the persistence of a good functional range of movement, together with an absence of bone erosion, may encourage the continuance of the abduction frame and traction, in the hope that, with complete quiescence, a full—or nearly full—range of movement is left. This possibility is an attractive one, but care must be used in selection of cases. An error of judgment may prove disastrous if the patient is left without either a useful range of movement on the one hand, or a safe and secure ankylosis on the other.

The usual result is an ankylosis—complete in some, incomplete in others, and sound or unsound accordingly. For the great majority of cases our aim should be to obtain as complete and as sound an ankylosis as possible. The immobilization by an accurately fitting plaster is valuable in promoting this. Traction too long continued tends to hinder the natural collapse and obliteration of the cavity resulting from bone destruction and in this way is prejudicial to sound healing. With the establishment of a state of quiescence in the affected hip, ambulatory treatment is commenced, at first without weight-bearing and later with progressive increase in the amount of walking and weight-bearing allowed. During this stage a short plaster spica is used, and finally, on discharge from hospital, a light appliance for support and protection during the early years of domiciliary treatment is provided.

Contrary to the commonly expressed opinion, I find that such a favourable and orderly progress is not by any means impossible in adults if the patient is fortunate in having his disease condition promptly discovered and in obtaining early and adequate treatment. On the other hand, in many cases in which treatment is not begun until a relatively late stage, complications have already developed, and it is then necessary to modify our scheme of treatment and to introduce other measures.

The main disadvantages of strictly conservative treatment are (1) that it is uneconomical because of the cost in time and money, and (2) that it is often ineffective because it fails to give a sound ankylosis. To remedy these defects operations have been introduced. These operations may be classified under three headings:—

(1) A direct attack on the local disease tissue in the hip. The old classical operation of excision of the hip-joint has been abandoned, although some surgeons still advocate a modified excision, which they perform during the course of the evolution of the disease, as a preliminary to an extra-articular arthrodesis at a later date. They aim at removing barriers to healing, and by producing a better coaptation of the bony surfaces, they believe that the arthrodesis, when performed, will have a greater chance of success.

(2) Extra-articular arthrodesis operations of which there are two main types. These are : (*a*) The so-called " early " arthrodesis as advocated by Hibbs, Albee, and others. This operation is performed during the active stages of the disease, with the dual purpose of accelerating recovery and producing a sound and safe healing. (*b*) The " late " arthrodesis operation performed at the end of the stage of evolution to provide an effective internal splint and thereby to reinforce and stabilize the imperfect ankylosis of conservative treatment.

(3) Other operative procedures such as : (*a*) Production of a pseudo-arthrosis which is valuable for elderly patients or for those to whom sitting down is important. (*b*) Corrective operations, such as various forms of osteotomy.

An enthusiastic acceptance of these operations—particularly the bone-graft procedures—is easily understood. Not only does the prospect of a reduction of the time-factor make operation an attractive proposition to surgeon and sufferer, but also the hope of escape from a long and laborious treatment, and the increased promise of a secure end-result, more than counterbalance the inconvenience and risks of the operative intervention.

Bone-graft surgery has therefore been applied extensively, sometimes indiscriminately, and often to the exclusion of any regard for other established principles of treatment. In recent years, however, there has developed a tendency for surgeons to restrain their enthusiasm and to restrict their operative activities when, in the light of further experience, certain difficulties and shortcomings become revealed. Many surgeons have become doubtful of any appreciable gain of time which would make the "early" operation in this respect worth while. The doctrine that every tuberculous bone and joint lesion has a certain minimum duration, before which it cannot be looked upon as healed, cannot be so easily set aside. Again in some cases the beneficent healing influence of the early graft has been lacking, because bone destruction in hip-joint disease is not simply due to a mechanical compression controllable by a successful bone-graft, but is due in part to a pathological destruction dependent on the disease process itself, upon which an otherwise successful fusion operation exerts little, if any, influence. In fact, it has become apparent that a successful fusion operation may on occasions be harmful by retarding the collapse and closure of the bone cavity produced by osseous destruction. The persistence of this cavity and the presence of caseous or fibrocaseous material therein tend to maintain a smouldering disease process which may reveal its presence by late abscess formation and other complications.

Other disadvantages of early operative intervention also have become apparent :—

(1) A definite mortality rate.

(2) An appreciable percentage of unsuccessful grafting, due in some cases to the destruction of the graft by the active tubercle bacilli, and in other cases to the depression by toxins of osteoblastic activity in the host bone, which affects a much more extensive area than the infected focus itself.

(3) Post-operative secondary infection and sinus formation.

In many cases these disappointments must be attributed to the surgeon and not to the operation. Bone-graft surgery suffered by becoming too popular. It requires a highly specialized technique, and it cannot be regarded as lying within the province of the inexperienced or occasional operator. Such operations demand, in addition, for their effective performance, a properly equipped hospital and a highly trained staff. Finally, it has not in all cases been realized that close and unremitting attention to detail is as essential in the operative and post-operative management of these cases as it is necessary in the treatment of tuberculosis of the hip by conservative means.

The present-day attitude of many surgeons to early operative intervention may be summarized in the words of Robert Louis Stevenson : " Delay, they say, begetteth peril ; but it is rather this itch of doing that undoes men."

When we turn to a consideration of the " late " arthrodesis operation there appears to be a much greater justification for its use, particularly in two respects :—

(1) At the end of evolution, when healing is being, but has not actually been, accomplished, this so-called late arthrodesis may be valuable for patients whose economic difficulties demand an early resumption of work, for those whose occupations necessitate severe strain on the affected hip, or for those whose circumstances are such that they will be unable, after discharge from hospital, to obtain adequate supervision.

(2) This form of operation is often required to reinforce and consolidate the imperfect and unstable results of conservative treatment. Many surgeons hold the view that conservative treatment in adults, rarely, if ever, gives a sound end-result, and advocate accordingly the routine performance of a bone-graft operation when the destructive tendencies of the disease process have ceased. From my experience I cannot advise this operation as a routine procedure. In only a small percentage of my cases have arthrodesis operations become necessary.

The after-care and supervision of patients with tuberculosis of the hip is extremely important. It is necessary to bear in mind that, even with a healed local lesion in the hip, our patients remain tuberculous. They continue to live dangerously. Frequently I have found the early hopes of a successful outcome frustrated by adverse social and economic circumstances. Although this aspect is not strictly an orthopædic problem, I feel that it is not without its interest or importance to us. Firstly, it demands that our patients should only be discharged from hospital when the local disease condition is as soundly and safely healed as we can make possible, and with the general health and resistance increased sufficiently to offset the harmful influences and circumstances which may affect them in their home lives ; secondly, it makes a long-continued supervision after discharge from hospital a necessary provision ; thirdly, it is desirable that there should be the closest possible co-operation with those who are required to accept the responsibility of domiciliary after-care. I appreciate that in some cases this co-operation does exist, but I feel that there is room for its more extensive application. Hospital treatment and domiciliary after-care should be closely linked together.

Finally, I should like to refer to patients treated under my care who were discharged from St. Luke's Hospital in the years 1931–36 inclusive. In this period 55 patients with adult tuberculosis of the hip were discharged. I have divided the patients into two groups : I—Without sinus formation on admission to hospital, and II—With sinus formation on admission.

In Group I there are 26 patients and all were treated on conservative lines.

15 (57·69%) have remained well over periods varying from one and a half to seven years.
2 (7·69%) have had arthrodesis operation performed on account of instability.
4 (15·39%) have been readmitted to hospital; 1 for correction of deformity by osteotomy, and 3 with recurrence of active disease.
3 (11·54%) have left the County of London and I have no further information available except that in one arthrodesis was recommended for instability.
2 (7·69%) are dead.

Of the 26 patients in Group I, 18 were males and 8 females. The average age on admission was 21½ years, the youngest patient being 17 years and the oldest 36. The average duration of hospital treatment was eighteen months.

In Group II there are 29 patients of whom

6 (20·69%) are well with healed sinuses after an interval of two to seven years from discharge.
3 (10·35%) have had operations performed elsewhere and are now reported well.
3 (10·35%) have been readmitted to hospital.
6 (20·69%) are untraced.
1 (3·44%) is at home with advanced amyloid degeneration.
10 (34·48%) are dead.

Although the number of cases is small, I feel that the figures for Group I indicate the possibilities of a successful outcome in quite a large number of cases as a result of general and local non-operative treatment, and that operative treatment is required in only a small percentage of cases. The figures relating to Group II indicate the much more serious prognosis when secondary infection is present.

Treatment of Tuberculous Disease of the Spine

By H. J. Seddon, F.R.C.S.

Although there have been no notable recent advances in the treatment of bone and joint tuberculosis, much may be gained from discussion of our present methods, and their precise application.

Adult tuberculosis of the spine merits our special consideration because, like so many other conditions, it has its own particular mythology (for which we as orthopædic surgeons are partly responsible) now well established in the textbooks and teaching schools. We believe that spinal fusion is of great value in adults, as opposed to children; it enables the time of treatment to be shortened, and ensures that healing of the spine will be sound. Is there any foundation for this belief, or is spinal fusion merely a matter of taste, or of expediency where there is lack of adequate open-air hospital accommodation? If fusion is of value should it be done early or late? Is it an alternative to prolonged rest in recumbency?

I shall attempt to answer these questions by giving the results of an investigation of the histories of 92 patients, of whom 88 have been followed up completely, some for over twenty years. Thirty-two were treated by spinal fusion and 60 conservatively. They were not all treated ideally; some of the earlier cases were given nothing more than a spinal support, and a few refused hospital treatment when it was available. From this heterogeneous collection it is possible to construct a fairly clear picture of the natural history of the disease, and a very clear one of its progress under conservative treatment.

Table I.—Age Distribution.

Number of cases in each 5-year age-group.

16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
24	25	14	11	8	5	0	2	2	1

The Untreated or Inadequately Treated Cases

Some patients die—how many we cannot say. The rest recover with more or less bone destruction and deformity, and once over the active stage have a fair prospect of freedom from relapse. Those with much bone destruction suffer from the usual effects of severe kyphosis—pulmonary and cardiac embarrassment, backache, and late-onset paraplegia due to imperfect healing of the disease (Seddon, 1935). Out of 11 surviving patients in this group, five recovered with gross deformity, and six with very little.

Cases Treated Conservatively

It is my experience that adult tuberculosis of the spine is not a destructive disease. In children we know that early and adequate conservative treatment does not always prevent the destruction of several vertebral bodies, but in adults four out of every five cases show a lesion involving only two vertebræ with but little tendency to progressive bone destruction. Metaphyseal infection is the characteristic adult lesion. I have not found a single case in which I could be satisfied that the primary bone focus was of the central or osteomyelitic type, or the rare subperiosteal or neural arch type. In the fifth case, bone destruction advances up to a point (as in children) and then generally ceases.

A certain number of patients die, some from tuberculosis elsewhere, others as a direct result of the spinal disease. The total mortality due to tuberculous disease during the five years after the onset of the spinal lesion is 19·3%; that due to the spinal disease alone is 12·1%. It is important to note that the behaviour of the local lesion has little bearing on the prognosis as regards life. A case showing minimal bone destruction may be rapidly fatal [1]; one at first showing progressive bone destruction may ultimately make an excellent recovery.

TABLE II.

1922-37 Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of patients observed in each year after the onset of the disease	92	85	76	68	56	48	41	32	25	22	14	13	10	8	8
Cases treated conservatively	60	53	47	42	36	32	29	24	22	19	12	11	9	7	7
Cases treated conservatively + fusion	32	32	29	26	20	16	12	8	3	3	2	2	1	1	1
Deaths due to spinal disease	3	1	2*	4				1†							
Deaths due to tuberculous disease elsewhere	1	3		1	1		1					1			
								All deaths in this group occurred in cases treated conservatively							
Deaths per cent. due to spinal disease	3·2	1·2	2·6	5·9				3·1							
Deaths per cent. due to tuberculous disease in the spine or elsewhere	4·3	4·7	2·6	7·3	1·8		2·3	3·1				7·7			
Causes of death ...	A F G H	3 A B	B D	2 A 2 B C	E		A	B				I			

* One fatality in a case grafted after leaving Stanmore (sinuses: toxæmia).
† Grafted before admission to Stanmore.

Causes of death			
	A	7	Pulmonary disease.
	B	5	Sinuses: toxæmia: with or without secondary infection.
	C	1	Sinuses: toxæmia: amyloid.
	D	1	Paraplegia: urinary infection.
	E	1	Meningitis.
	F	1	Rupture of abscess into trachea: asphyxia.
	G	1	Rupture of abscess into œsophagus: secondary infection: toxæmia.
	H	1	Rupture of abscess into pleura: toxæmia.
	I	1	Tuberculous disease of suprarenals.
		19	

The influence of visceral lesions.—The existence of tuberculous disease in a viscus gravely affects the prognosis. The following figures show that the mortality is increased almost sixfold if there is, or has been, frank involvement of the lungs or abdominal viscera. Skeletal lesions (e.g. involvement of the hip or knee) are comparatively uncommon and do not appear to have any great influence on the end-result.

Cases with visceral lesions (lungs 15, lungs and suprarenals 1, salpingitis 2): 18, with 11 deaths—61% mortality.

Cases with no obvious visceral lesion: 74, with 8 deaths—11% mortality. Relative mortality—61 : 11.

Response to treatment.—Here we find the most astonishing variations. One patient recovers without ever receiving adequate treatment, another is fit to get up after nine to twelve months in an open-air hospital. Yet another has a stormy passage with troublesome abscess-formation or paraplegia, requiring two, three, or four years in hospital. One patient dies in a few months, another after four years of lingering

[1] The total mortality in this group alone was 9·3%.

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PLATE I.

FIG. 3A.

FIG. 3B.

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PLATE II.

FIG. 3C.

FIG. 3D.

FIG. 3.—To illustrate the remarkable variations in response and in the time taken to recover from the spinal lesion. A. Lesion of Th7-8 and Th9-10 in a patient aged 30. No treatment apart from dressing an abscess that ruptured in the loin. Well eighteen years later (Case No. 6). B. Lesion of Th12-L1 in a patient aged 35. Left hospital against advice after only five months' treatment. Subsequent progress satisfactory—went through two pregnancies without difficulty. Well four years later (Case No. 54). C. Lesion of Th12-L1 in a patient aged 22: new bone formation anteriorly within the first few months of the disease. Persistent trouble with abscesses and sinuses for seven years. Finally healed soundly: well during last three years (Case No. 65). D. Lesion of L3-4 in a patient aged 39. Bilateral psoas abscesses on admission—never showed any sign of healing. Remained in hospital for two years before dying from toxæmia and exhaustion: no evidence of secondary infection at any time (Case No. 10).

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illness. The average stay in hospital is about twenty months, and this average is not affected if we eliminate the fatal cases (fig. 2).

The explanation of this remarkable variation in response (so different from the state of affairs in children where it is always necessary to assume that the disease

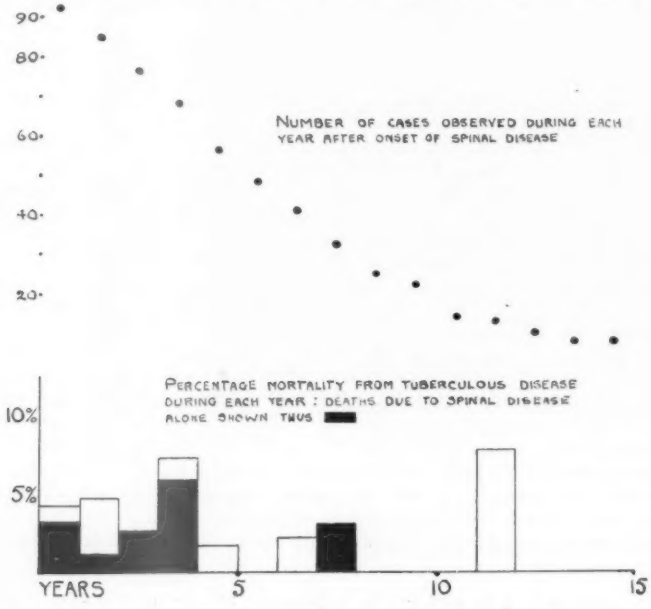

FIG. 1.

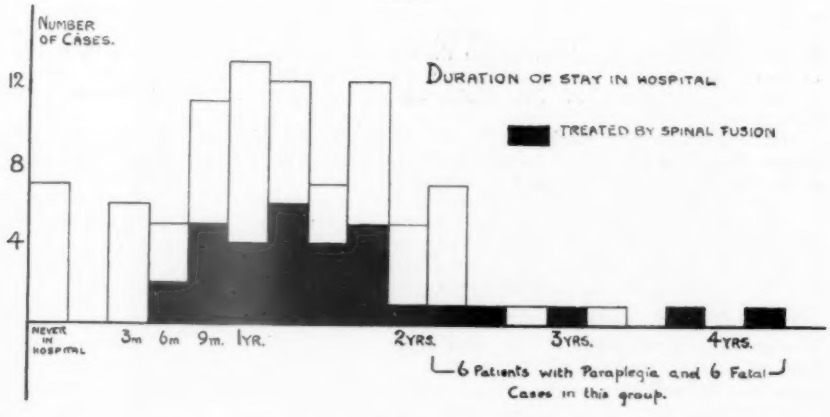

FIG. 2.

will be severe and require prolonged treatment) is not known for certain. But I would suggest that adults have had time to develop more or less resistance to tuberculous infection—unlike children, most of whom are naturally susceptible like guinea-pigs. One adult is almost immune—his lesion is minimal and heals quickly. Another has little resistance and reacts poorly (fig. 3).

Final result.—Once the patient is past the four-year mark from the onset of the disease, the prospect is almost rosy. There is little chance of his dying from spinal or any other form of tuberculous disease, and he has more than a 50% chance of developing sound bony fusion of the affected vertebral bodies.

Comparison of cases treated conservatively with those receiving no treatment at all shows conclusively that conservative treatment almost always curtails the local ravages of the disease, and it is reasonable to believe that, in spite of our still lacking a specific remedy for tuberculosis, the combination of measures that we call conservative treatment has drawn the sting from a once fatal and crippling disease. At the same time the total mortality is still depressingly high.

Yet the price paid by the community (in money), and by the patient (in money and time), is a heavy one—about twenty months in hospital. Can we possibly improve matters by speeding up the treatment in the more favourable cases that show little bone destruction ? They might, perhaps, be treated by early grafting. Most of us have seen, perhaps been responsible for, patients treated successfully by early operation, and able to leave hospital after a stay of only a few months.

To place such a venture on a rational basis means making an early prognosis, both as to the local and general condition. Can it be done ? Let us take in order the signs that may be of help :—

(1) The general condition. When a patient is first seen he may be obviously ill or apparently very well. Yet the sick man may become plump and cheerful after a few months in the open air, and the apparently sturdy patient may, alas, go downhill in spite of being in the most favourable surroundings. We can tell only by waiting.

(2) Pigmentation. It is well known that good pigmentation is a favourable sign, though the prognosis is generally bad in patients who pigment very deeply. But this sign again depends upon seeing how the patient responds to conservative treatment, and in any case is much too indefinite for our purposes.

(3) Serial radiographs. These too can be obtained only through the passage of time.

It is our practice to take radiographs at intervals of four months—occasionally two or three months, if there is reason to suspect the presence of a rapidly destructive lesion. The series of negatives usually shows the following stages in the progress of the disease: (*a*) the initial lesion—generally nothing more than a thinning of one intervertebral disc. There may be rarefaction of the adjoining vertebræ, though increased density, particularly in the parts of the bodies adjoining the narrowed disc, was present in 11% of the adult cases.

(*b*) Commencing erosion of the surfaces adjoining the disc : disc still thinner: perhaps further rarefaction.

(*c*) In a severe case this destructive process may continue for many months, but the time comes when bone destruction ceases, and the vertebral bodies are in good contact, with little or nothing of the disc remaining between them.

(*d*) A period of from four to eight months during which there is no change, merging into

(*e*) The period of healing characterized by close apposition of the affected vertebræ and a disappearance of rarefaction. During this period the patient is allowed to get up.

(*f*) At a later date, after the passage of between one and five years, unmistakable signs of bony fusion appear. The lesion is then soundly healed.

Valuable as they are, serial radiographs alone are not an entirely reliable guide to the patient's reaction to the disease. One patient may recover in a year, another patient, with a lesion showing the same progress radiographically, may die within nine months or linger on for three years. If serial radiographs can occasionally be so misleading, how much more difficult is it to make a prognosis from the initial picture ? In my opinion it is impossible (fig. 4).

(4) The erythrocyte sedimentation rate. We have been making observations on the E.S.R. at Stanmore during the last three years. It is certain that if the E.S.R. is high (50–100 Westergren) the disease is very active ; but so far we have not found

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PLATE III.

FIG. 4A (i).

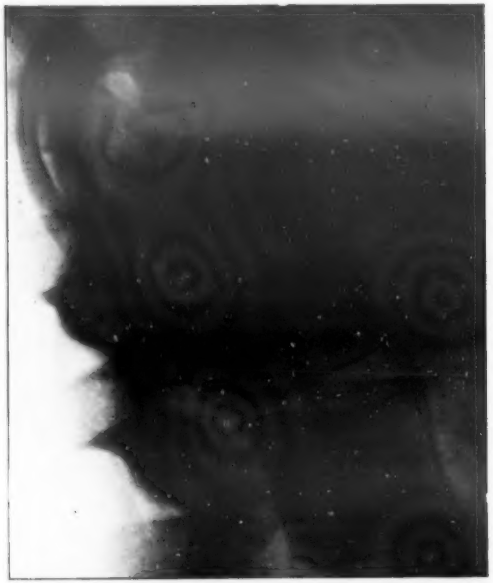

FIG. 4A (ii).

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PLATE IV.

FIG. 4A (iii).

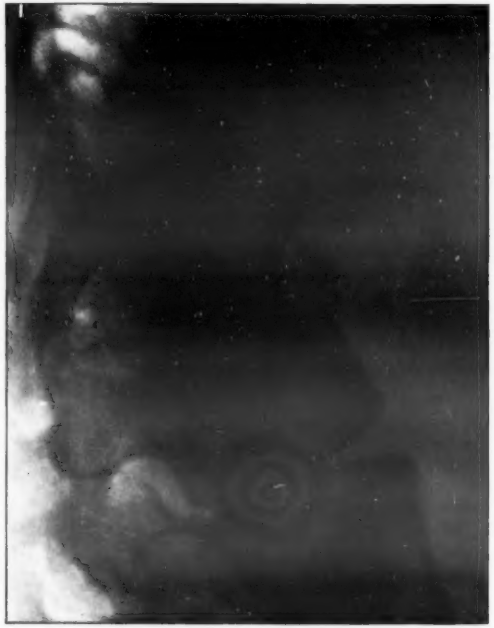

FIG. 4A (iv).

FIG. 4.—A. Serial radiographs of the spine in a woman aged 23 (Case No. 20) who made an uninterrupted recovery after only fourteen and a half months in hospital.

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PLATE V.

FIG. 4B (i).

FIG. 4B (ii).

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FIG. 4B (iii).

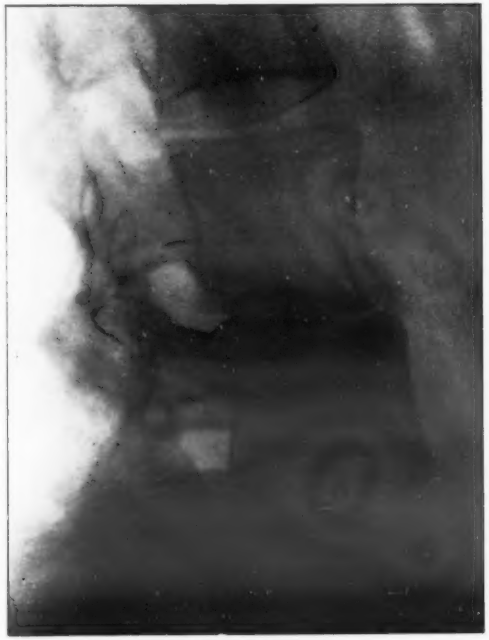

FIG. 4B (iv).

FIG. 4.—B. Serial radiographs of the spine in a previously healthy woman aged 39 (Case No 10) who died from tuberculous disease of the spine after two years in hospital. She also had tuberculous salpingitis.
These two series of radiographs show how unwise it would be to attempt a prognosis from radiographic evidence alone.

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that the converse is true—namely, that a low E.S.R. indicates a relatively benign lesion. In any case I think it is still too early to make any definite pronouncement on the value of this interesting and rather mysterious test, in so far as joint tuberculosis is concerned.

Even taking these four prognostic signs together, I would hesitate to forecast the course of the disease in a particular case. I am convinced that one can tell only by waiting. One thing, however, is fairly certain : the patient with a visceral lesion is likely to do badly.

There is an alternative approach. Since I have shown that bone destruction is negligible in four-fifths of the cases treated conservatively (though it must be remembered that in 9·3% they die of the disease), it may be suggested that all cases should be grafted early—with a fair prospect that the majority will do well and be spared perhaps a year in hospital. In the remainder one would have to hope for the best.

This is, in fact, the policy at Hibbs' clinic where early spinal fusion is the routine treatment. Here are some of his figures, with mine for comparison. Unfortunately, Hibbs does not state the mortality rate in the 16–30 age-group (Hibbs, 1928).

	Hibbs	*R.N.O.H.*
Patients over 30 years	17 cases	29 cases
	54% total mortality	24%

There is nothing to suggest that the difference is attributable to tuberculosis in America being a more virulent disease, and I think it is not unconnected with the lack of conservative treatment in Hibbs' adult cases.

Where one is dealing with malignant disease such as carcinoma of the breast, early and radical treatment is imperative. In a relatively benign disease, where there is a safe and perhaps more effective alternative to operation, the surgeon who intervenes early in every case is pursuing a course not easily justified.

Before going further into this question of spinal fusion, it is necessary to consider current views on the function of the bone graft.

(1) Mechanical : Most of us agree that an autogenous bone graft applied to the adult spine is a remarkably efficient splint, and as such has a wide field of usefulness. But in tuberculous disease it is a two-edged sword. If fusion is performed early, it can generally be relied on firmly to lock the affected vertebræ. Should the disease continue to advance after the operation (and we know that this can happen), a cavity is created which is prevented by the graft from closing (Calvé, 1935, McKee, 1937). Pott realized that the natural process of healing is by ankylosis—at first fibrous and later bony—between the involved vertebral bodies ; in his own words " this is the thing aimed at ".

An early graft may interfere with this process. It is remarkable that although we all appreciate the importance of obliterating cavities to obtain sound healing in chronic osteomyelitis or infection of the mastoid cells, and are prepared to perform heroic operations to collapse a tuberculous lung, there seems to be some difficulty in understanding that Pott's disease should be allowed to heal in the same way. Left to itself—it will do so.

(2) Biological : Certain surgeons, notably Albee, believe that the graft, by increasing the local blood supply, assists in the healing of the disease. Whatever may be the experimental evidence supporting this hypothesis, the clinical fact is that early spinal fusion does not stop the progress of the disease, not even in a majority of the cases. Hibbs, again, has provided us with evidence on this point, and there is no doubt that the technique of spinal fusion as performed at the New York Orthopædic Hospital is superb. The figures are as follows : Out of 286 cases of all ages there was no increase in deformity (i.e. no progressive bone destruction) in only 123 (Hibbs, 1928). Similar evidence is provided by McKee (1937). Furthermore, it

is well known that abscesses, sinuses, and amyloid disease, and paraplegia sometimes occur after "successful" spinal fusion—so called. For these reasons I have little if any faith in the biological action of the graft for tuberculous disease of the spine.

If a graft is to be used at all, it should be in the final stage of conservative treatment—after bone destruction has ceased, and after the affected vertebral bodies have been allowed to fall together so that fusion can occur. This has been the policy at Stanmore during recent years, and we felt entitled to expect that the results would show: (1) Reduction in the duration of hospital treatment; (2) accelerated fusion of the diseased vertebræ; (3) abolition of the necessity for wearing a support for a long period; (4) freedom from recurrence of the disease.

What, in fact, have been the results?

(1) The average time in hospital for the grafted cases was eighteen months. That for patients treated conservatively was twenty months, and this includes all the cases that lingered on, dying from spinal disease and phthisis. There is, at most, a possible saving of two months. But at Stanmore spinal fusion is reserved for cases in which the prognosis is good, and this in itself might be sufficient to account for the difference of two months in favour of spinal fusion.

(2) It seems reasonable to suppose that bony fusion posteriorly would be followed fairly quickly by bony fusion of the affected vertebral bodies, provided that collapse is allowed to occur before the operation is performed. At the same time we must remember that healing by bony fusion is a not uncommon result of purely conservative treatment.

Here I cannot give a figure expressed as a percentage that is of any value. It was not possible to take serial radiographs after discharge from hospital in every case, and the group of cases is not, therefore, sufficiently large to allow of simple analysis. But the figures show that fusion of the bodies is every bit as frequent after purely conservative treatment as after conservative treatment plus fusion—if not more frequent (Table III).

TABLE III.—TIME WHEN FUSION OF VERTEBRAL BODIES OCCURRED AFTER DISCHARGE FROM HOSPITAL.

	Conservative Treatment		Conservative Treatment + Fusion	
Time	Fusion present	Fusion not yet present	Fusion present	Fusion not yet present
6 m.	2			
1 yr.	3	1	2	1
	3		3	1
2 yrs.	1			2
	1		2	1
3 yrs.	1		1	
			1	
4 yrs.	2			
			1	
5 yrs.		1	2	
6 yrs.	1			1
over 6 yrs.		1		1
	14		12	
	17		19	

The series of cases treated by fusion is the more recent, and it is possible that some of the cases not showing fusion at the present time will do so later. Even so, the average time before fusion occurs will be greater in the series of cases treated by operation.

(3) Figures dealing with the length of time that a spinal support is worn cannot be very accurate, since the caprice of the patient affects this more than any other stage of the treatment. Some patients attend wearing supports that look surprisingly clean, and one suspects that they are worn only for ceremonial appearances at the

out-patient department. Others develop an affection for a spinal support that one can only describe as pathological, and no amount of argument can persuade them that the apparatus is no longer necessary. Here are the figures for what they are worth in 50 cases in which the information is accurate. Patients treated conservatively wore supports for an average period of two years and three months—those treated by spinal fusion, for one year and nine months : a saving of six months.

(4) Spinal fusion has no noticeable influence on the incidence of late recurrence of the disease. Such recurrence was present in only three cases—one treated conservatively, and two by spinal fusion.

The only benefits, therefore, that may be credited to spinal fusion in the treatment of tuberculous disease of the spine are a saving of two months in the period of hospital treatment, and six months when the spinal support is being worn. Although in our hands the operation has no mortality and has been devoid of serious complications, I am by no means convinced that it is worth while as a routine procedure.

Nevertheless there are certain uncommon indications for operation that are worth consideration, and I give them in order of importance.

(1) Pain at the site of the lesion, due not to active disease, but to an unsound fibrous ankylosis. There were five such cases in this series—patients who were readmitted on account of pain, which was abolished completely by spinal fusion.

(2) Persistent fibrous ankylosis with no radiographic evidence of progress towards bony fusion. This condition has much in common with (1) inasmuch as it is often associated with a distressing feeling of weakness in the back. But it usually follows the more destructive lesions of childhood, and operation is, therefore, more commonly indicated in young adults who suffered from the disease years before. There were only three adult cases of this type ; they were all relieved by operative fusion, and the affected vertebræ subsequently became fused by bone.

(3) Occupation. A music mistress does not need a fusion operation, but the operation may be valuable for a waitress—or a commercial traveller who has to spend hours in walking or in driving a car.

(4) High thoracic lesions are notoriously slow to heal by bony fusion, and it is difficult to supply an adequate spinal support that is comfortable. It is now my practice to treat such cases by spinal fusion, and to allow the patient to leave the hospital without any form of external splinting. I am not yet able to say that this is a sound policy, but it seems promising.

Conclusions

Adult tuberculosis of the spine is best treated conservatively. Provided that there is no associated visceral lesion, the prognosis is good (total mortality 11%), and the risk of local recurrence very small. The presence of a visceral lesion renders the outlook most unfavourable (total mortality 61%).

A comparison of cases treated on purely conservative lines, with those treated conservatively and by terminal spinal fusion shows that the addition of the operation (1) reduces the period of hospital treatment by two months $\left[\begin{smallmatrix}18\text{ months}\\20\text{ months}\end{smallmatrix}\right]$; (2) reduces the period during which a support is required by about six months $\left[\begin{smallmatrix}21\text{ months}\\27\text{ months}\end{smallmatrix}\right]$; (3) delays fusion of the vertebral bodies by many months—perhaps for more than one year.

There is therefore hardly sufficient justification for the routine performance of the operation.

In this series of patients there was a deliberate selection of the cases for operation. However, this does not invalidate the comparisons that have been made, since spinal

fusion was reserved for the more favourable cases, and the conclusions are slightly *against* the operation. If alternate cases had been subjected to operation, it is likely that the verdict against spinal fusion would have been much stronger.

Finally, my own opinion was strongly in favour of spinal fusion as the final stage in the conservative treatment, and I have performed the operation 40 times on patients at all ages from 8 years upwards. It came as a rude shock to find one's cherished beliefs shattered by a dispassionate examination of a fairly well documented series of cases. I therefore feel justified in presenting these conclusions as the true interpretation of the facts.

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Section of Odontology

President—FRANK J. PEARCE, L.D.S.E.

[*February* 28, 1938]

The Relationship of Pre-normal Occlusion to the Early Loss of Deciduous Molars

By R. ERNEST RIX, M.R.C.S., L.R.C.P., L.D.S.

THE question to be discussed is the relation of pre-normal occlusion of the lower dental arch to the early extraction of deciduous molars. In the cases cited all the lower incisors bite labially to the upper incisors. Fig. 1 shows a typical example. The abnormal arch relationship has a marked effect on the profile, as one would expect. Not only is the chin too far forward but the upper lip is unduly flattened by the confining effect of the lower incisors upon the upper front teeth. The effect of the pre-normal lower arch is apparently also felt at the back of the upper arch for, when the occlusion is finally corrected in the antero-posterior direction, the upper first

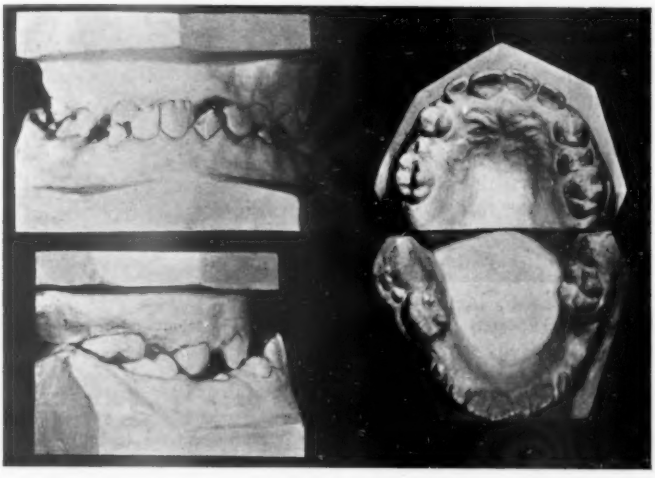

FIG. 1.—D. C., aged 9 years 10 months. Severe pre-normal occlusion. Typical of the cases collected in Tables I and II.

molars on one or both sides often assume a position of linguo-occlusion to the lowers. Not infrequently they are in linguo-occlusion before treatment is begun.

The antero-posterior relation of the upper and lower first permanent molars in the cases collected varies considerably on account of the drifting of these teeth subsequent to the frequent extraction of deciduous molars. Their relation, therefore, cannot be taken as an indication of the relation of the two arches to one another. In passing one should mention that, where extractions had taken place, it was noticed that the upper first molars moved forward readily. The lower first molars moved but little, and the movement, if any, was mostly a mesial tilt.

It is significant that dental surgeons in the better-class districts will tell you that they do not see many pre-normal cases, yet at clinics and hospitals in poorer neighbourhoods the condition is not uncommon. In every hundred orthodontic cases examined at Guy's Hospital I see about six with severe pre-normal occlusion. The 6% remains constant year by year. That its distribution appears to vary in localities with differing economic conditions would make one hesitate to say that most cases have a genetic origin, though our textbooks give the impression that the influence of heredity does determine the majority.

In 1929 I saw three children in quick succession who appeared to offer a likely clue as to its origin. All three showed the typical underhung bite. The lower incisors overlapped excessively and labially to the uppers. The children were between the ages of 8 and 9 years. Neither parent could recall a similar condition among relatives, and each said that the baby teeth were in good position. The trouble had become apparent with the eruption of the permanent front teeth. On closer inspection it was found that deciduous molars were present in only one of the three cases. In this case the four upper molars were there, but the lower ones had been

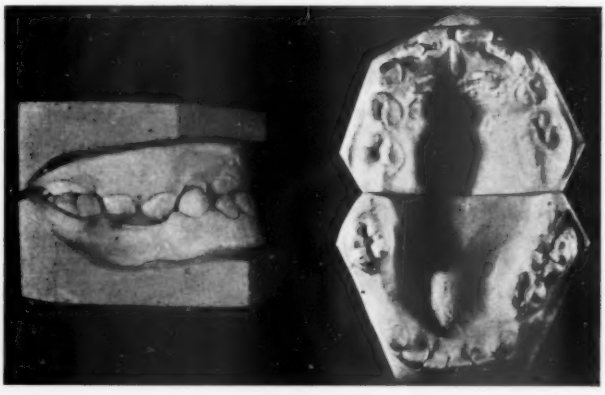

FIG. 2.—J. L., aged 8 years. $\frac{D \mid D}{\mid E}$ present, but unable to contribute to the support of the bite on account of the loss of the other cheek teeth at the age of 5 years.

extracted. Each child had had the extractions just after school, beginning at the age of 5 years.

The three coincident points in these cases, which one took to be of note, were that there was no family history of the deformity, that enough cheek teeth had been extracted to bring about a grave loss of occluding area, and that this loss occurred at the age of about 5 years. So many subsequent children examined revealed materially the same antecedent story, that one could hardly escape the conclusion that the condition was an induced one.

A group of 50 pre-normal occlusion cases collected at Guy's Hospital revealed that 42 of them had had extensive extractions of deciduous molars between the ages of 3 and 7 years. In many cases all the temporary molars were gone, and in others there had been an unfortunate combination of upper and lower extractions which prevented the remainder from functioning properly (fig. 2). More lower teeth were extracted than upper. One has a definite impression that, in general, more deciduous lower teeth are extracted than upper, so that there may not necessarily be any ætiological significance in this anomaly.

TABLE I.—50 CASES OF PRE-NORMAL OCCLUSION.

A.	With multiple extractions of deciduous molars, 3-7 years... ...		42
B.	With few or no extractions		8
		Total	50
	A. Group of 42 cases		
	With family history	5	
	No family history	37	
	Total	42	
	B. Group of 8 cases		
	With family history	7	
	No family history	1	
	Total	8	
	Percentage with no family history who had multiple extractions ...		88%

Of the 42 cases having early extractions, 37 gave no family history of the deformity. In other words 88% without family history had had multiple extractions of deciduous molars.

The original group of 50 pre-normal cases was examined from another point of view. Out of 50 there were 38 who gave no family history of the deformity.

TABLE II.—50 CASES OF PRE-NORMAL OCCLUSION.

C.	With family history		12
D.	No family history		38
		Total	50
	C. Group of 12 cases:		
	With multiple extractions of deciduous molars, 3-7 years	5	
	With few or no extractions	7	
	Total	12	
	D. Group of 38 cases:		
	With multiple extractions of deciduous molars, 3-7 years	37	
	With few or no extractions	1	
	Total	38	
	Percentage with multiple extractions giving no family history ...		97%

Among the 38, no less than 37 had had multiple extractions of deciduous molars. The remaining one had had no extractions and had probably brought about the pre-normality by an atypical form of thumb-sucking. In this analysis, therefore, 97% with multiple extractions gave no family history. The preponderance of the factor of molar extractions in the production of pre-normal occlusion is most marked.

In reviewing the cases several points of interest emerge. It is not the loss of masticating area *per se* which is of importance. It is rather the loss of resistance to the bite. In the age-period of 3 to 7 years the first permanent molars are either not yet erupted or at most not fully erupted, and so will not be able to offer resistance to a closing bite. It might be maintained that towards the end of this period, i.e. about 7 years, the first permanent molars are probably fully erupted, but it is unlikely that they would be able by themselves to prevent some closure. In over-closing, the mandible, by its very shape and inevitable path of movement, comes a little too far forward. This seems to be the first and fundamental condition necessary to the development of the pre-normal occlusion. The development, however, depends upon yet other circumstances which must exist in consort.

The percentage of deformities at Guy's Hospital complicated by, or actually created by, the loss of deciduous molars is extremely high. I would put it at about 50%, yet only some 6% are in severe pre-normal occlusion. There are obviously other limiting circumstances. The age-period at which the extractions are done is one of them.

It will have been noticed that the upper age limit for the extractions was 7 years: no cases had had multiple extractions at 8 or onwards. At the age of 7 the central incisors have ordinarily erupted and have assumed a normal overlap; they are in a position to offer support and resistance to a closing bite. But before that age the incisors may not have erupted sufficiently to overlap (fig. 3). An over-closed mandible, carrying the lower arch too far forward, will then permit the lower central incisors to erupt a little too labially. A normal incisor overlap is an insurance against the deformity. Extractions of deciduous cheek teeth do not reverse this advantageous overlap when once it is established. But extractions previous to the assumption of the overlap may permit of an abnormal one, and when once the lower central incisors are labial to the uppers the whole deformity seems assured. From then onwards the ugliness of the child increases with the further eruption of teeth. The second important factor, therefore, is the age at which the extractions are done.

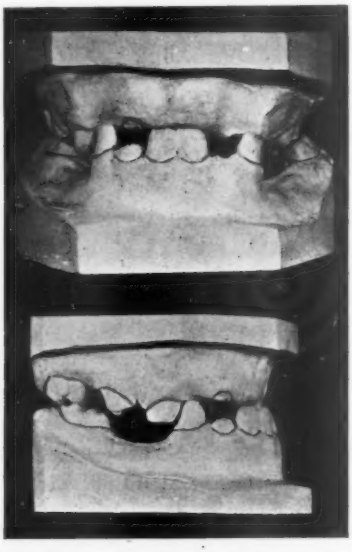

FIG. 3.—J. A., aged 6 years 9 months. $\underline{E}|$ present. Other deciduous molars extracted 5 years. Upper incisors about to erupt lingually to the lowers.

There is a third aggravating factor which causes the already over-closed mandible to be, as it were, dragged into a still more anterior position. It is brought about by the way the deciduous upper and lower anterior teeth occlude with one another. The case shown in figs. 4 to 8 will illustrate the mechanism. The patient was 6 years and 10 months old. Her mother said that the temporary incisors overlapped nicely and normally when they first came through; there is only her word for it, as no earlier models were obtained. There was no family history of pre-normal occlusion. $\frac{|D}{ED|E}$ were extracted nine months prior to the taking of the models, and $\frac{|E}{|D}$ were extracted during the preceding month. At some time the child must have had an edge-to-edge bite, as the upper incisors bear obvious signs of attrition (fig. 6). The lower arch is in a slightly pre-normal position. It may be argued that the occlusion was always pre-normal, though the child certainly was not so pre-normal that the lower incisors were always labial to the uppers. On the other hand the attrition may have occurred

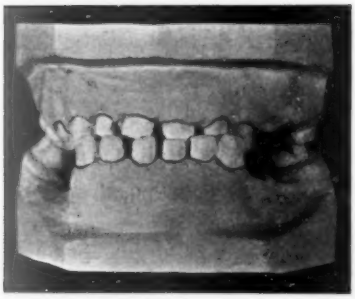

FIG. 4.—B. P., aged 6 years 10 months. E D | present. Other deciduous molars extracted during the previous nine months. BA | A edge to edge. C | BC lingual to the lowers.

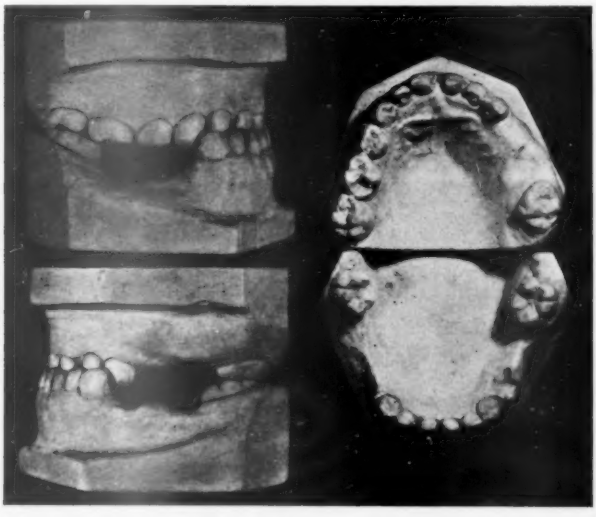

FIG. 5.—Same case as in fig. 4. Lower deciduous canines beginning to over-ride the uppers.

FIG. 6.—Same case as in fig. 4, showing attrition of incisors.

with the arches in a normal relationship to each other and progressed further after the extraction of the molars. The deciduous central and right lateral incisors are still just occluding edge to edge with the lowers, but the upper left lateral and both canine teeth are now occluding lingually.

Whatever the initial arch relationship may have been, this patient affords a good example of the manner in which a slightly pre-normal lower arch is guided more forward still when the resistance to the bite is lost. Models were taken again four months later. The overlap of all the incisors with the exception of a very loose upper

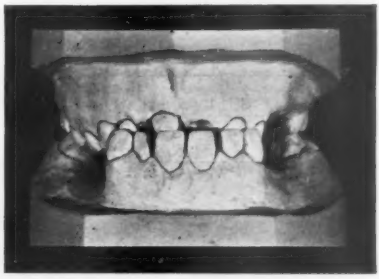

FIG. 7.—Same case as in fig. 4, four months later. Incisor overlap increasing.

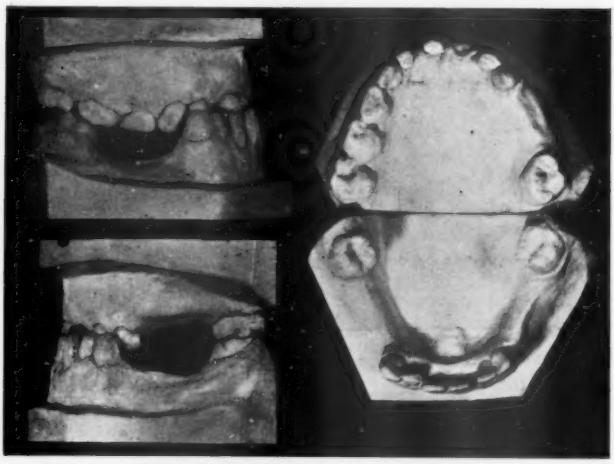

FIG. 8.—Same case as in fig. 7. Comparison with fig. 5, shows lower deciduous canines over-riding the uppers more as the bite closes, and the mandible being guided forward.

central tooth has now increased (fig. 7). The loose tooth is still edge to edge, and although the photograph does not show it clearly, it is markedly labio-clinated. Its incisive edge is being carried up by the increasingly overlapping lower incisors. It can be seen that the closing bite is causing the lower canine teeth to ride on the upper teeth and, in so doing, the mandible is guided still more forward at the moment of closure (fig. 8).

Before leaving this case it is worth while to point out that, on the left side in the upper jaw, the temporary canine is free to drift distally, but not on the right, where

its position is maintained by the presence of the deciduous molars. The final position of the permanent left incisors is therefore likely to be even worse than that of the right incisors.

Fig. 9 shows a similar example. The deciduous molars were extracted at the age of 5½ years. The upper central incisors are just erupting inside the lowers. The models are separated a fraction in the lateral view, to show how the incisive edge of the upper deciduous lateral, receiving the impact of the lower deciduous canine, has been notched as the teeth meet edge to edge. The more the lateral wears down the more will the cusps of the temporary canine teeth over-ride one another and sling the mandible forward. Before very long the lateral will be shed. The canine cusps will then over-ride still more and carry the mandible yet further forward.

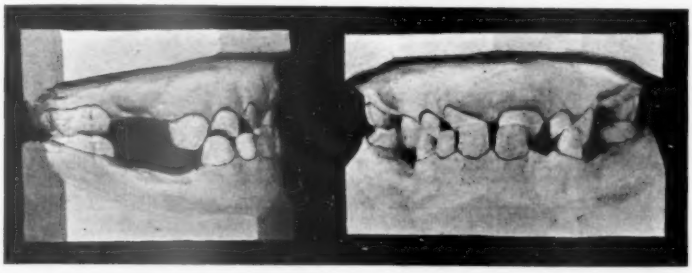

FIG. 9.—J. W., aged 7 years. All deciduous molars extracted at 5½ years. In the lateral view the models have been separated a fraction to show the attrition of $\underline{B}|$.

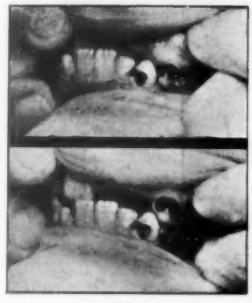

FIG. 10.—F. A., aged 6¼ years. All deciduous molars extracted at 4 years. (*a*) Teeth in occlusion. (*b*) Bite opened with vulcanite bite-blocks.

There is one more example which reveals clearly to what a considerable extent the mandible may be slung forward at the moment of closure. A boy who has lost his deciduous molars at 5 years is shown in the biting position in fig. 10, *a*. Note the relation of the upper and lower canines. The inclined planes of their cusps are forcing the over-closed mandible markedly forward. One upper central tooth has erupted. It is completely hidden from view. If the bite is opened with vulcanite bite-blocks (fig. 10, *b*) the canines at once assume a more normal antero-posterior relationship. The upper central tooth is now less hopelessly related to the lowers. The opening of the bite has improved the position of the mandible and removed it from the influence of deflecting cusps.

When a fully developed case of this induced type of pre-normal occlusion is

examined it is usually found that, however protruded the lower incisors are with the arches in occlusion, the patient can, by opening a little, succeed in getting the upper and lower centrals almost edge to edge. The mechanism of the over-riding cusps which has just been explained gives the clue to the very considerable improvement obtained in the position of the mandible, even in later life, as soon as the teeth are separated. It is on this account that treatment is not so difficult as it would at first appear and the results are for the most part gratifying.

The fourth point of importance is the occlusion prior to the extractions. Sim Wallace in his Cartwright Prize Essay of 1920–25 showed that the upper and lower arch relationship in the antero-posterior direction changes normally during the period

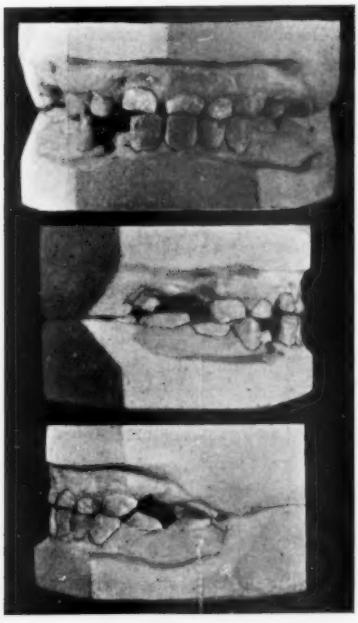

FIG. 11.

FIG. 12.

FIG. 11.—G. H., aged 6 years $\frac{D|D}{}$ extracted one month previously. $\frac{E|E}{}$ very carious. All remaining deciduous molars were extracted after the models were obtained.

FIG. 12.—Six months later. Lower dental arch becoming pre-normal and the upper incisors starting to erupt lingually to the lowers.

of growth. A comparison of models of a normally developing mouth taken at, say, the ages of 2, 6, and 12 years, reveals that the so-called " normal " varies. There is a relative forward drift of the lower dental arch upon the upper. Now it appears that the very dental arches which are developing along these ideal lines are the most prone to drift into pre-normal occlusion. One can pick out the cases in which it would be dangerous to extract the deciduous molars. Dr. Milo Hellman in the February 1937 issue of the *International Journal of Orthodontia* says, " In watching children for lengthy periods of time it is surprising to find that some dentitions previously recorded as normal or as Class 1, suddenly appear as Class 3 ". Proof of the damage done to arch relationship by extraction of deciduous molars is revealed by pursuing some

further remarks of his which are unconsciously pregnant. He goes on to quote a case, with illustrations, of normal occlusion in a child aged 5 years who returned to him after two years with pre-normal occlusion. In describing the changed condition he says, "All the deciduous teeth with the exception of the canines and the maxillary left lateral were gone". He is puzzled at the rapid change from normal to pre-normal in such an unexpected way. He does not connect the sequence of events at all with the extractions but argues that there are incalculable periods of acceleration of abnormal growth.

I personally have not been fortunate enough to find such a perfect example as his case presents, but there must be others who, seeing more normal cases than I do, will sooner or later procure models tracing the development from beginning to end. The only examples that I have obtained have been already partly mutilated. The dentition illustrated in figs. 11 and 12 shows a case in point. A period of six months separates the taking of the first and last models. Unfortunately both upper first molars were extracted one month before the first models were obtained, and the second deciduous molars were so carious and broken down that they no longer contributed much to the resistance of the bite. The arch relationship was normal. All the remaining deciduous molars were then extracted. In six months the incisor relation-

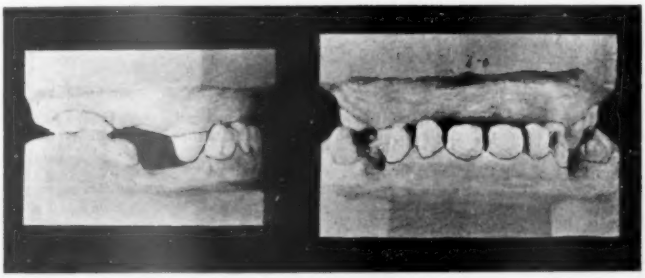

FIG. 13.—J. S., aged 8 years 2 months. All deciduous molars, except $\overline{|D}$, extracted between the ages of 4 and 6 years. Lower arch is pre-normal. Upper incisors have not yet erupted.

ship had become abnormal (fig. 12). The upper incisors are erupting lingually to the lowers. The upper and lower canine teeth are beginning to over-ride one another in the way already illustrated in fig. 9.

Working in the opposite direction in an endeavour to prove the main contention of this paper, I looked for an early, developing pre-normal occlusion brought about, as I thought, by the early extractions of deciduous molars. One such case is shown in fig. 13. It has every promise of developing along typical lines. The deciduous cheek teeth, with the exception of $\overline{|D}$, were extracted between the ages of 4 and 6. The bite has closed, bringing the lower jaw slightly too far forward. The upper and lower canine teeth are riding on one another in such a fashion that the lower jaw is slung even more forward at the moment of closure. The first upper permanent molars are in linguo-occlusion with the lowers. It is too early for the permanent incisors to have erupted enough to establish any sort of overlap. One hopes it would be agreed that in a few years' time the condition could not be anything other than a very obvious pre-normal occlusion.

It would be expected that, if the bite were reopened to correct the ill-effects of the early extractions, the teeth in the two arches would erupt into normal relationship. Vulcanite bite-blocks were inserted into the lower jaw which gagged the bite on the upper temporary canine teeth and events awaited. Models taken at the end of nine

months showed that the upper incisors were beginning to erupt and to overlap the lowers correctly (fig. 14). In passing it will be noticed that the lower centre line has moved to the left. There is an unfortunate locking of the left deciduous canines. The upper and lower intercanine widths are not correctly adjusted to each other now that the lower arch is more posteriorly situated. The upper first molar is in linguo-occlusion with the lower on one side. That which was a too-narrow upper to occlude correctly on each side in the lateral direction with a protruded lower, can now occlude correctly at least on one side with the lower arch back in its proper position. These maladjustments in the lateral direction are often seen.

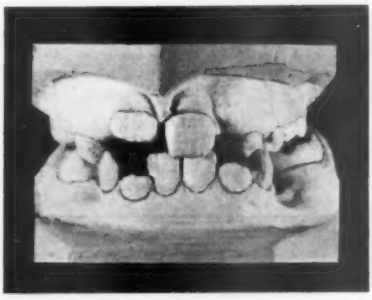

FIG. 14.—Same case as in fig. 13, nine months later. Lower vulcanite bite-blocks have been in use. Upper incisors are erupting labially to the lowers. The mandible has moved to the left.

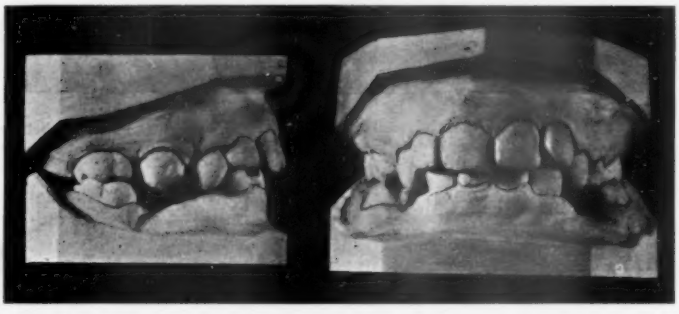

FIG. 15.—Same case as in fig. 14, nine months later. With continued use of lower bite blocks all the incisors have erupted correctly. $\overline{C}$ has been extracted. The mandible has moved back to the centre.

After a further nine months of the use of bite-blocks the condition continued to improve. In an attempt to correct the swinging of the mandible to the left the $\overline{C}$ had been removed. It can be seen in fig. 15 that all the incisors are now nicely related and the centre line is right.

Over and above the severe pre-normal cases which make up 6% of all irregularities seen at Guy's Hospital, there is a further smaller group, not yet mentioned, of some 4% where there is a lesser degree of pre-normality and where a varying number of upper incisors succeed in erupting labially to the lowers. The majority of these also have had multiple extractions of deciduous molars. The cases illustrated in figs. 16, 17, and

18 are fairly representative. In fig. 16 the upper right lateral incisor has almost, but not quite, attained a correct position. In figs. 17 and 18 one and two incisors respectively are "over the bite". It is interesting to note that it is usually the upper incisors on the right side that erupt into good position, and the mandible, more often than not, swings a little to the left. The three cases illustrated show these peculiarities. It may be that during sleep more time is spent lying on the right side than on the left, and the pre-normal mandible is encouraged to the left as an unconscious attempt is made to adjust the relatively too-wide lower arch to the upper.

Adding the 6% to the 4%, and making allowances for the small proportion of cases which are probably hereditary in origin, it can be seen that a very considerable

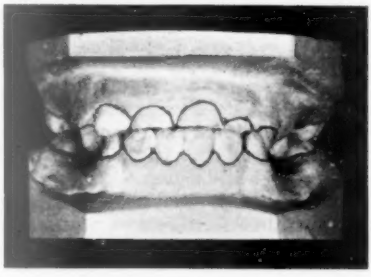

FIG. 16.—P. S. Pre-normal occlusion with $\underline{2}|$ almost "over the bite". The mandible has moved to the left.

FIG. 17.—C. R. Pre-normal occlusion with $1|$ labial to the lowers. The mandible has moved to the left.

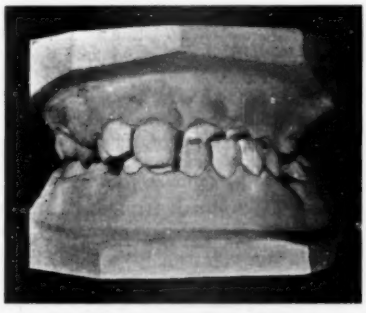

FIG. 18.—F. W. Pre-normal occlusion with $21|$ labial to the lowers. The mandible has moved to the left.

number of the total irregularities examined in a poor neighbourhood, such as surrounds the hospital, are errors of arch relationship in the pre-normal direction brought about by the early loss of deciduous molars.

I am indebted to the Dental Research Department of Guy's Dental School for facilities granted me in the preparation of the illustrations.

Summary.—Doubt is felt concerning the acceptance of the assertion that most cases of pre-normal occlusion are hereditary in origin. Pre-normal occlusion is now not an uncommon condition in the poorer districts. At Guy's Hospital 6% of all orthodontic cases present the deformity in a marked degree with all the lower incisors biting labially to the uppers. An analysis of fifty such cases attending

hospital reveals a high percentage giving a history of early multiple extractions of deciduous molars and a low percentage with a family history of the deformity. Of those with no family history 97% had had multiple early extractions.

It appears that the loss of the cheek teeth permits the bite to close at a critical age. In over-closing, the mandible tends to carry the lower dental arch into a too forward position. In certain circumstances this tendency is facilitated.

Three conducive factors are recognized :—

(1) When the extractions take place before the age of 7, or before the permanent incisors have established a normal overlap.

(2) When the occlusion is normal prior to extractions.

(3) When the mandible and lower dental arch are guided markedly forward at the moment of closure by the way the upper and lower deciduous canine teeth over-ride one another.

An early case is cited in which these factors were operating to produce a pre-normal occlusion. By re-opening the bite the deformity corrected itself.

A further group of some 4% of all irregularities examined at hospital are pre-normal. The pre-normality however is not so severe, and a varying number of upper incisors succeed in erupting labially to the lowers. Most of the cases give a history of multiple early extraction of deciduous molars.

A total of 10% among hospital orthodontic cases are pre-normal to a greater or lesser degree, with the pre-normality for the most part artificially induced.

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WALLACE, SIM, "Variations in the Form of the Jaws", London, 1927.

Discussion.—Mr. K. E. PRINGLE said that he could confirm some of Mr. Rix's figures. His own were taken from an examination of 850 original models of cases under treatment during 1937 by Mr. Bocquet Bull at Guy's Hospital. The percentage of pre-normal occlusion cases was practically the same as Mr. Rix's. There were 52 cases, i.e. 6·5% fully established and just over 4% showing the condition to a lesser degree.

Mr. Rix had said that he had the impression that lower extractions were more common than uppers. In his own examination 70% of all cases had lost one or more lower temporary molars or canines whereas 54% had lost upper teeth. He could offer no figures based on family histories but had formed the opinion, judging by models alone, that at Guy's Hospital the apparent or pseudo-pre-normal occlusion cases as described by Mr. Rix were at least ten times as common as the true type.

Mr. W. A. SOWDEN HILLS said that the pre-normal movement of the mandible due to the early loss of the deciduous molars was a subject which he himself had been investigating for the last six months at the Croydon Dental Clinic which incorporated a large orthodontic clinic.

Mr. Rix's investigations coincided with his. He thought that the main causative factor in the forward movement of the mandible was the articulation of the deciduous canines in that the lower tended to ride up the mesial aspect of the upper and so draw the mandible forwards and upwards to an eventual close-bite condition; that was, of course, where the first permanent molars were not in occlusion.

Bite-blocks, with—where necessary—retraction wires for the lower incisors, were used and two cases so far had been rectified but not before it had been found necessary to remove the two lower deciduous canines. He agreed with Mr. Rix that those cross-bite conditions found were to the left, though he had one which had moved to the right. Efforts on the part of such children to close in the median position resulted in occlusion only with the deciduous canines meeting tip to tip.

Mr. J. G. TURNER drew attention to the fact that most of the maxillæ shown were subnormal, i.e. suggested association with adenoids. The compressing force of lips and cheeks had also to be considered.

He had extracted all the temporary molars and canines in a child aged 6 years who was free from adenoids, and the result had been a perfect occlusion. He would on no account remove sound temporary canines.

Section of Anæsthetics

President—I. W. MAGILL, M.B.

[*April* 1, 1938]

Ether Narcosis and Carbohydrate Metabolism

By C. L. G. PRATT, M.D.

(*Physiologist to the Department of Anæsthetics, University of Oxford*)

ALTHOUGH it has long been agreed that ether anæsthesia influences the blood-sugar level more or less profoundly, a survey of the literature reveals that surprisingly little precise information is available. Only a few detailed studies have been made in the human subject, and of these perhaps the best known is that of Minnitt (1932). Comparing the effect upon the blood-sugar of ether and of nitrous-oxide anæsthesia, he demonstrated that the former agent produces a much greater hyperglycæmia than does the latter. In a number of instances the blood-sugar level, normal before anæsthesia, rose after the operation to more than 200 mgm. %. According to Lawrence (1929), all forms of anæsthesia mobilize liver glycogen, and ether, partly as the result of the work of Minnitt and others in the human subject, and partly on the basis of animal experiments, has been regarded as probably the most potent hyperglycæmic anæsthetic drug. It is of some importance, therefore, to decide, firstly, the degree of interference with carbohydrate metabolism produced by ether narcosis, secondly, the duration of this effect, and thirdly, whether the hyperglycæmia can be in the nature of a physiological compensatory phenomenon, or whether it necessarily denotes a pathological derangement of function.

A preliminary answer to the first two questions is provided by a consideration of 40 consecutive cases in which the blood-sugar has been closely followed through the period of anæsthesia and for some time afterwards. In this investigation the blood-sugar was determined by the Patterson (1937) modification of the Hagedorn-Jensen method. Since in most investigations hitherto, Maclean's method seems to have been used, it is necessary to point out that the present method gives results nearer to the true blood-sugar, i.e. about 20 mgm. % lower.

The most striking feature of the results is their lack of uniformity. It might be expected that the blood-sugar, if it rose at all, would continue to rise throughout the period of narcosis, or at least until the concentration of anæsthetic agent in the tissues had reached a constant level. Such a finding is illustrated in fig. 1, where the blood-sugar curve continues to rise from the beginning to the end of anæsthesia, but this effect is by no means the most common. When there is a steady rise of blood-sugar it is generally of a much less impressive order, such as in fig. 2. In other words, the disturbance of the level of the blood-sugar, although nearly always present, is only occasionally very marked, usually producing a rise of not more than 40 mgm. % and maintaining the glycæmia well within the recognized physiological limits.

Almost half the cases so far studied have shown a response to ether anæsthesia qualitatively as well as quantitatively different from that just described. In these cases (e.g. fig. 3) there is an early rise of blood-sugar followed by a fall which is continued until the anæsthetic is withdrawn. The blood-sugar sometimes begins to fall after about twenty minutes from the commencement of induction and the fall may continue for an hour or more, although the concentration of ether in the tissues, as judged by the clinical degree of anæsthesia, is not diminished. It is probable that in

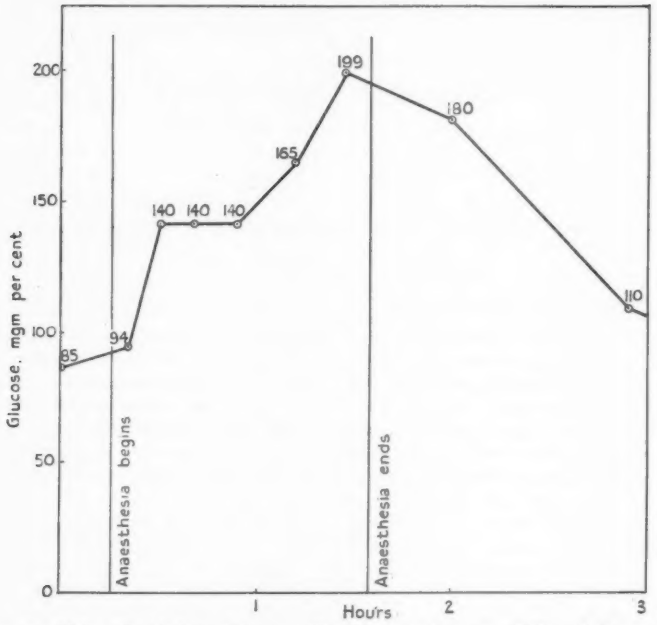

FIG. 1.—Male, 52, cholecystectomy. *Premed.*, atropine gr. 1/100. *Induc.*, ethyl chloride. *Mainten.*, open ether.

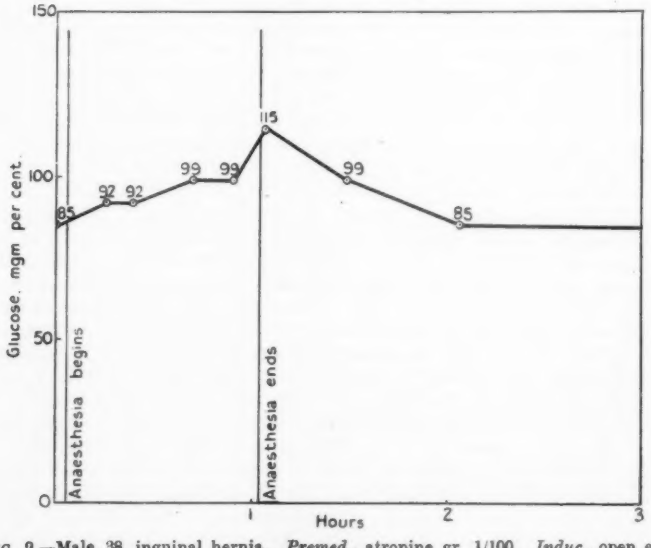

FIG. 2.—Male, 38, inguinal hernia. *Premed.*, atropine gr. 1/100. *Induc.*, open ether. *Mainten.*, open ether.

these cases the initial rise of blood-sugar accompanies the excitement of induction and is due to the production of adrenaline by the suprarenal glands, which ceases when the anæsthesia becomes sufficiently profound. Banerji and Reid (1933) showed, in animals, that the hyperglycæmia of ether anæsthesia is greatly diminished, though not entirely abolished, by removal of the suprarenal glands. They concluded that the hyperglycæmia of laboratory animals brought about by the administration of ether is due to the formation of adrenaline. Nature never uses pathological processes to perform such an experiment clinically, but there is no reason to suppose that the human organism differs fundamentally from that of the cat or dog in its response to ether vapour.

In the human subject a rise of blood-sugar may accompany induction of anæsthesia by ether, even when no detectable stage of excitement is observed. The use,

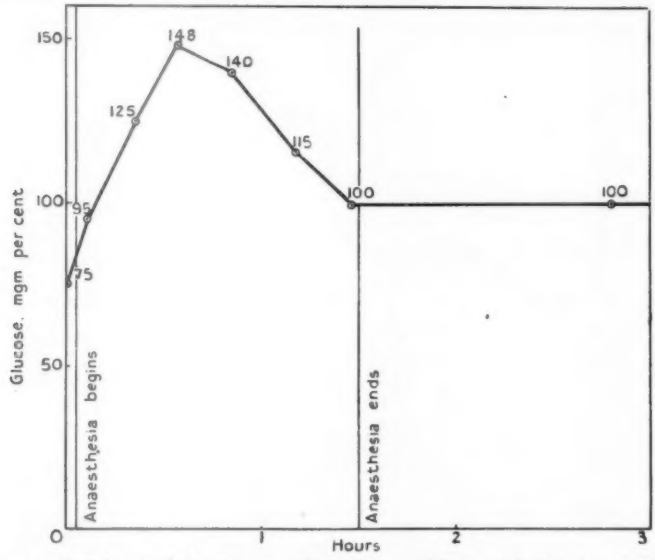

FIG. 3.—Female, 45, hysterectomy. *Premed.*, morphia gr. 1/6, atropine gr. 1/100, hyoscine gr. 1/150. *Induc.*, open ether. *Mainten.*, open ether.

as premedicating agents, of morphia, atropine, hyoscine, omnopon, nepenthe, nembutal, or combinations of these, in the usual therapeutic dosages, has no easily recognizable influence upon the rise of blood-sugar during or immediately after induction. Although they have varying effects on the tranquillity of the patient and on the ease of induction from the technical point of view, a rise of blood-sugar accompanies the administration of ether just as frequently with, as without, their use. Induction of anæsthesia by means of ethyl chloride followed by ether may obviate all signs of excitement, but an initial hyperglycæmia is just as often seen as when ether alone is used for induction. Similarly, the use of nitrous oxide to produce a preliminary unconsciousness may be followed by a prompt rise of blood-sugar when ether is subsequently administered. These findings indicate that ether has a direct stimulating action on the production of adrenaline rather than that the (inconstant) hyperglycæmia associated with the early phase of ether narcosis is the secondary result of general nervous excitation.

In order to demonstrate that the usual pre-anæsthetic drugs exert no material effect in restraining ether hyperglycæmia, anæsthesia was induced and maintained,

in one case, by the use of open ether without any premedication. The course of the blood-sugar is shown in fig. 4. In this particular case ether did not produce any alteration in the blood-sugar beyond a slight initial *fall*, suggesting that the premedicating agents may tend to increase the hyperglycæmia rather than to diminish it. Such a fall of blood-sugar at the beginning of ether anæsthesia is rare, but brief minor fluctuations are not uncommon. Fig. 5, showing a small but steady fall after half an hour of anæsthesia, not preceded by any rise, illustrates a much less usual state of affairs.

It is clear that individual variations play so considerable a part in the precise effect of ether narcosis on the course of the blood-sugar that responses conforming closely to a predictable standard pattern are not to be expected. Nevertheless, on analysis of all the results taken together, certain deductions may be, on the whole, not unjustified. The significance of the common increase of blood-sugar in the early

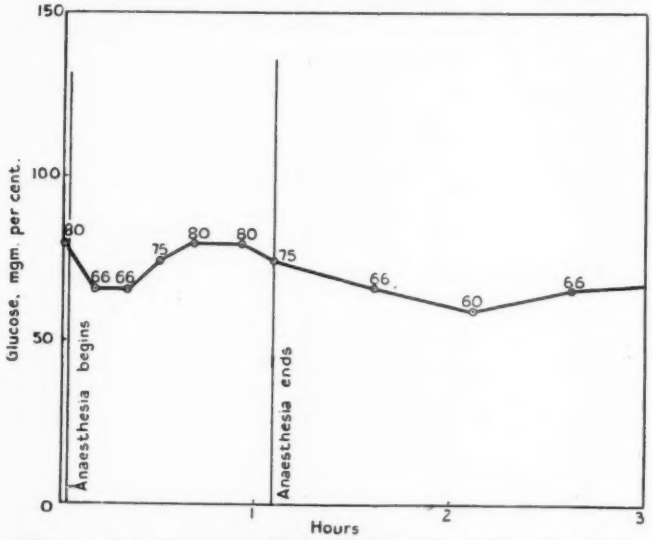

FIG. 4.—Male, 48, inguinal hernia. *Premed.*, nil. *Induc.*, open ether. *Mainten.*, open ether.

stages of ether anæsthesia has already been mentioned. This preliminary rise may be followed by a further rise or by a fall, or the new high level may be maintained with only minor fluctuations until the ether is withdrawn. The lack of correlation between the changes in blood-sugar during the earlier period of ether anæsthesia and the changes which occur later on suggests that the total effect can be regarded as the sum of two different and independent actions. The initial increase of blood-sugar due, probably, to the action of adrenaline, usually tends to decline within thirty to forty minutes of induction of anæsthesia. The second, later, effect on the mobilization of glucose is much less constantly seen. If it has begun to appear within about thirty minutes, the blood-sugar curve may climb continuously until the end of the administration of ether, or may at least not begin to fall until that point, i.e. until the amount of ether in the tissues is allowed to fall below the concentration necessary for surgical anæsthesia. Sometimes, as in fig. 6, the primary and secondary phases may be separated by an interval during which the blood-sugar level commences to decline, the curve therefore showing two maxima.

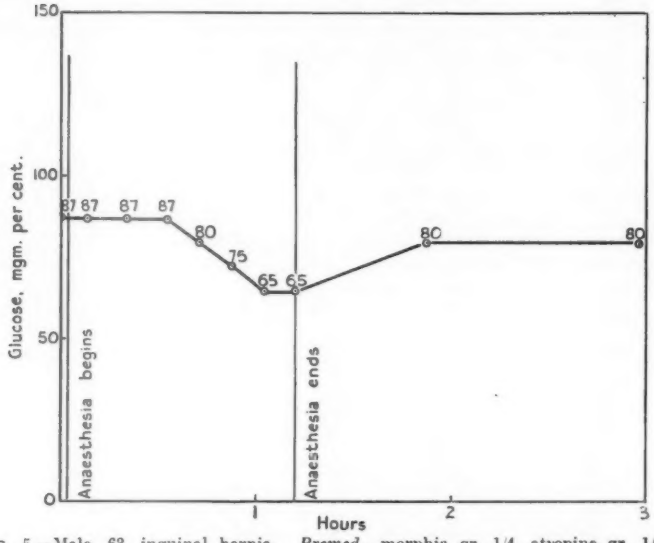

FIG. 5.—Male, 63, inguinal hernia. *Premed.*, morphia gr. 1/4, atropine gr. 1/100, hyoscine gr. 1/100. *Induc.*, ethyl chloride. *Mainten.*, open ether.

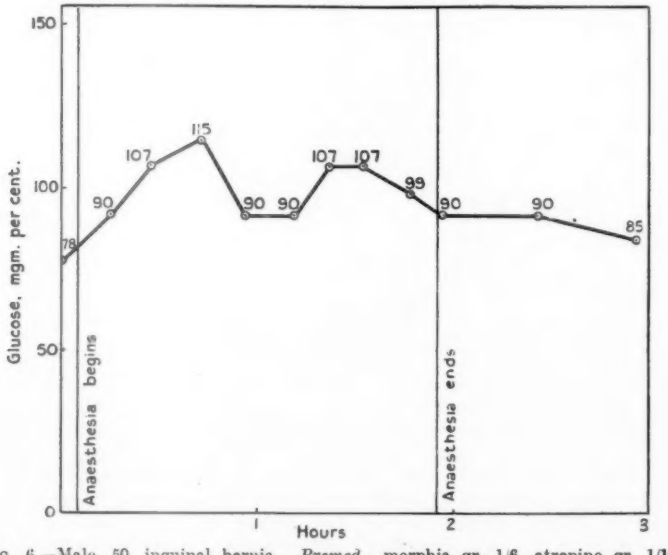

FIG. 6.—Male, 50, inguinal hernia. *Premed.*, morphia gr. 1/6, atropine gr. 1/100, hyoscine gr. 1/150. *Induc.*, open ether. *Mainten.*, open ether.

The more slowly developing secondary phase is most probably related to the depth of anæsthesia. Inami (1931) concluded that the degree of metabolic disturbance produced by ether narcosis in rabbits depends upon the depth of anæsthesia ; that is, upon the tissue-concentration of ether. The suggestion is borne out by the results of experiments upon two cats, summarized in figs. 7 and 8. In the first animal full

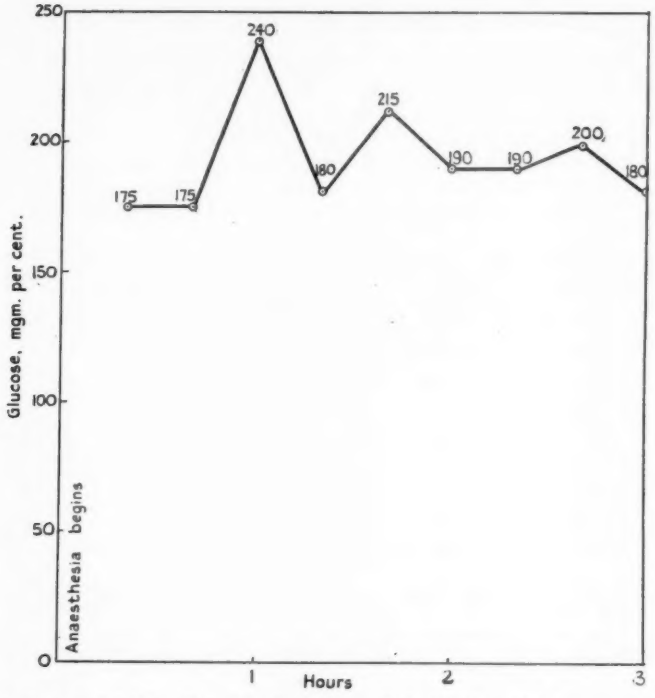

FIG. 7.—Cat, 3·2 kilo. *Premed.*, nil. *Induc.*, ethyl chloride. *Mainten.*, open ether. Deep anæsthesia (cf. fig. 8).

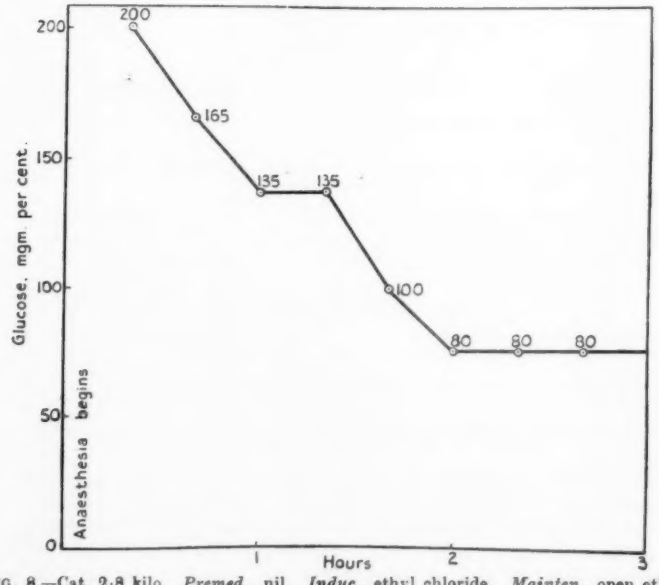

FIG. 8.—Cat, 2·8 kilo. *Premed.*, nil. *Induc.*, ethyl chloride. *Mainten.*, open ether. Light anæsthesia (cf. fig. 7).

surgical anæsthesia was maintained for four hours by means of ether, after induction with ethyl chloride. The arterial blood-sugar, apart from small fluctuations, remained at about 200 mgm. % for the whole of that time. In the second cat, ether was applied much less generously, and although the animal was immobilized by the anæsthetic, the conjunctival reflex was just present almost throughout the experiment. The blood-sugar was 200 mgm. % immediately after the induction of anæsthesia, but progressively fell until it reached normal resting limits, where it remained. It would appear, then, that a greater concentration of ether is required to maintain the blood-sugar at a high level than is necessary to raise it to that level.

Whilst the early rise can be explained as an adrenaline effect, the secondary rise is possibly due to direct interference by the toxic agent with some intermediate phase of carbohydrate metabolism. The mechanism is unknown. In addition to the mobilization of liver-glycogen, Major and Bollman (1932) have demonstrated that

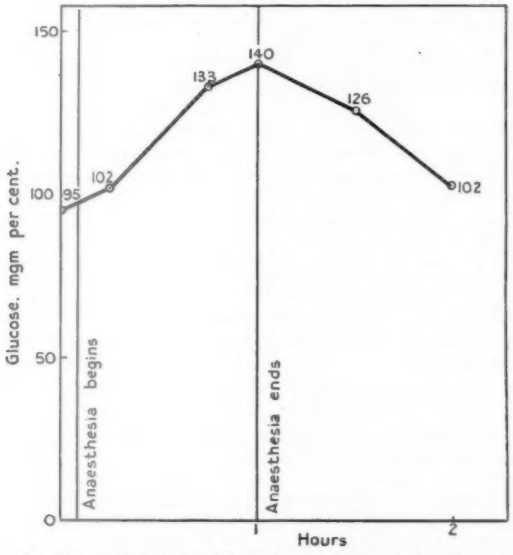

FIG. 9.—Female, 30, ovariectomy. *Premed.*, omnopon gr. 1/3, hyoscine gr. 1/150. *Induc.*, cyclopropane. *Mainten.*, cyclopropane.

ether diminishes the glycogen of the muscles. The work of Stehle and Bourne (1924), may contain a clue to the problem. According to these investigators the acidosis which often accompanies ether anæsthesia is due to the discharge, into the blood-stream, of phosphoric acid. It is possible that ether in sufficient concentration prevents the synthesis of glycogen from hexose phosphate or that it interferes in some other way with the utilization of hexose phosphate in the normal progress of carbohydrate metabolism. This, of course, is mere speculation, but it is justified if it fulfils its purpose, namely, to call attention to the existing lack of information with respect to the intimate nature of the action of ether upon tissue metabolism in general and upon carbohydrate metabolism in particular.

Ether is not the only anæsthetic agent capable of raising the blood-sugar. Especially in view of statements to the contrary, it may be pointed out that even cyclopropane has a similar (though not necessarily so marked) effect. Fig. 9 exemplifies the influence of cyclopropane. Chloroform and nitrous oxide both disturb the blood-sugar level in the same way.

Four points emerge from this brief and tentative study. These are :—

(1) Whatever the characteristic effect of ether on the blood-sugar level, it is subject to numerous exceptions, which may be described as individual variations in susceptibility.

(2) The effect of ether seems to be twofold. The primary glucose mobilization apparently brought about by adrenaline, may or may not be followed, according to the depth of anæsthesia, by a secondary, and probably more profound, interference with the normal course of sugar utilization.

(3) The effect is not specific to ether, being shared by other anæsthetic agents.

(4) There is little evidence to suggest that the rise of blood-sugar is other than a welcome physiological compensatory phenomenon.

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Discussion.—Dr. R. J. Minnitt said that in research work undertaken in 1924-25 upon patients under anæsthesia, he had found that when gas-oxygen and minimal amounts of ether were used, the rise of blood-sugar was less than when open ether was the agent, and also that this rise varied with the depth of anæsthesia. He had been impressed by the effect upon the sugar tolerance, which was diminished by the anæsthetic. These points seemed to have a bearing upon the toxicity.

With regard to the use of oxygen during anæsthesia, observations were now being carried out in the Department of Anæsthesia of Liverpool University, and this was found to raise the blood-pressure markedly when a fall had taken place. Oxygen was, he thought, the most valuable agent for improving the condition of the patient. He would like to know, however. whether any information could be given as to how the blood-pressure reacted after the use of oxygen.

Professor R. R. Macintosh : When Dr. Pratt was appointed Physiologist to the Department of Anæsthetics at Oxford two months ago, we discussed some of the principal problems requiring investigation. Modern anæsthetic agents and technique have resulted in improved pre- and post-operative comfort of the patient, but the incidence of vomiting still remains distressingly high. Investigation into carbohydrate metabolism during anæsthesia is being undertaken, in the hope that eventually the results will guide us in the treatment of certain cases of vomiting. So far Dr. Pratt's figures do not confirm the findings of other workers that anæsthesia invariably produces a rise in blood-sugar.

The problem of vomiting is obviously a complex one and does not depend solely on the anæsthetic or the administrator. Two patients will have similar operations on the same day under apparently similar conditions. One will make an uninterrupted recovery ; the other will vomit intermittently for twenty-four hours. One patient will be quite fit shortly after deep ether anæsthesia ; another will be prostrate for hours even after nitrous oxide expertly given.

Mr. C. Langton Hewer said that he could not quite agree with Dr. Pratt's statement that prolonged apnœa was innocuous provided that anoxia was absent. This condition could readily be produced in anæsthesia, either by the insufflation endotracheal technique or by deep cyclopropane narcosis. In the former case it was due to a low alveolar carbon dioxide percentage, and in the latter to direct depression of the respiratory centre. It was possible to keep a patient quite free from cyanosis for an indefinite period with no respiratory movements, a condition much appreciated by surgeons operating upon the upper abdomen. On closely observing such patients, however, it was apparent that deterioration soon set in, as evidenced by a rising pulse-rate and a falling pulse-pressure. In his (the speaker's) opinion, this was due to inadequate filling of the heart owing to cessation of the "respiratory-pump" effect, and he considered it unwise to leave a patient in an apnœic condition for more than a few minutes at a time.

Section of Surgery

SUB-SECTION OF PROCTOLOGY

President—J. P. LOCKHART-MUMMERY, F.R.C.S.

[*March* 9, 1938]

The Technique of Operation for Carcinoma Coli: A Plea for an Eclectic Attitude

By CECIL JOLL, M.S.

THE object of this short paper, based on a series of upwards of 200 cases, is to endeavour to focus attention on what, in my opinion, are the fundamentals of success in extirpation of malignant neoplasms of the colon, and in particular to combat the heresy which appears to be creeping back into surgical teaching and practice—namely that multiple stage operations such as those usually classified under the term Mikulicz-Paul are preferable to axial or lateral anastomoses. It is advanced by those who favour the former methods that they are less risky for the amateur or dilettante surgeon, but since our object should be to discourage the activities of all such, this argument should carry little weight.

The real objections to the Mikulicz-Paul operation are as follows :—

(1) It cannot be carried out so as to permit of a sufficiently radical extirpation of bowel and mesocolon, except in a limited class of case. In fat and elderly patients, for whom it is otherwise legitimately indicated, it is often impossible to mobilize, for instance, a sigmoid growth sufficiently to permit of satisfactory exteriorization, compatible with a reasonably wide removal of bowel and mesentery.

(2) The average stay in hospital, as compared with that in cases treated by resection and anastomosis, is approximately double. Also it must not be ignored that every extra operative procedure adds its risk of pulmonary embolism, in these elderly patients especially.

(3) The abdominal wall is rarely so strong after the Mikulicz-Paul operation, since there is a decidedly weak area at the site of the double fistula, which frequently results in a troublesome hernia.

No surgeon to-day would attempt seriously to combat the view that preliminary drainage of all cases with the slightest suspicion of obstruction or stasis is necessary, but this does not mean that such elaborate methods as those of Devine are really usually required. The failures in anastomotic operations on the colon are referable, not to an insidious peritoneal infection by the ordinary flora of the colon, but to errors of technique which result in gross leakage. If such leakage can be obviated, or limited and provided for, then the attempt at sterilization of the bowel, which is in any case chimerical, need not preoccupy us.

The properly conducted cæcostomy will do all that is necessary in most cases to drain the bowel, particularly if a very large tube of a slightly modified Winsbury-White pattern is used. This has a very wide flanged aperture as large as or larger than that of the lumen of the issuing tube ; it is capable of carrying off all but solid fæces, more particularly if lavage with olive oil followed by saline is employed. At the end of ten days' careful preparation, even in previously highly-obstructed cases, the

bowel is usually absolutely empty. Finally, if the cæcum is replaced within the abdomen, the tube alone protruding, at least 75% of such fistulæ will close spontaneously within three weeks of the major procedure. There are, however, cases in which the presence of scybalous masses throughout the colon above the obstruction makes any form of lateral drainage such as cæcostomy useless. It is in these that Devine's method is preferable to the Mikulicz-Paul operation, since the total period occupied by the necessary operative stages, though greater than that required by the resection methods preceded by cæcostomy, is less than that of the Mikulicz-Paul. The necessity for preliminary drainage of the bowel in nearly all cases having been recognized, there are still a few admitting of one-stage resections. There can be no real excuse for preliminary cæcostomy in non-obstructed carcinoma of the proximal colon when age or some other form of decrepitude does not preclude it, and nothing can be smoother than the convalescence after such one-stage operations, particularly if a small cæcostomy-type tube is inserted into the blind end of the transverse colon to safeguard the anastomotic line of the ileo-colostomy from any rise of intracolonic pressure. Similarly one-stage operations are often feasible for carcinoma of the transverse colon, though in this event the operation should be completed on the same principle, inserting the cæcostomy tube naturally through a separate incision; it will have closed spontaneously as soon as the main abdominal wound is healed.

There still remains the problem of the resection of the bowel, particularly in the distal colon. The advocates of lateral anastomosis point to the technical difficulty of axial anastomosis and urge the danger of stricture at the site of end-to-end anastomosis. This danger appears to be greatly exaggerated, and not one instance of failure of the axial anastomosis to function satisfactorily occurred in the series under consideration, even though at the end of the operation in several cases the available lumen appeared decidedly small. Lateral anastomosis cannot be achieved in any but a small percentage of cases, if sufficient bowel is to be extirpated, and when it is feasible there is more than a possibility of trouble arising in connexion with the blind ends of the bowel, which have a remarkable tendency to become elongated and even to give rise to problems of fæcal stasis.

The objections to axial anastomosis are mainly (1) that it is difficult, and (2) that it is dangerous, owing to the alleged frequency of leakage and peritonitis.

The difficulty in the technique of end-to-end anastomosis lies in the problem of mobilization and access. Mobilization, so far as the splenic flexure, descending colon, and upper sigmoid, are concerned, is a matter which is almost invariably soluble provided sufficient abdominal relaxation by the anæsthetist is associated with a thoroughly adequate incision. It is in obtaining access to a short distal portion of sigmoid or pelvic colon that the real difficulty arises. The simplest instruments facilitate those more difficult operations and it is here that the use of terminal crushing forceps—such as the Parker-Kehr pattern or some modification of it—is so valuable, much more so than Payr's clamps, which are not nearly so handy.

Surgical textbooks are curiously reticent as to what is to be done with the obtrusive appendices epiploicæ, and other fat-laden tags which obscure the bowel in so many cases. If they are left in situ they interfere with satisfactory placing of sutures. If they are removed, a good deal of peritoneum is sacrificed in the process, to say nothing of the troublesome bleeding. The best course appears to be to reflect them for about $\frac{3}{4}$ in. from each segment of bowel, control bleeding points with fine ligatures, and then proceed to carry out a two-layer anastomosis, cutting away with sharp scissors, after removing the Kehr forceps, the thin layer of crushed bowel which was in their grasp, and meanwhile controlling the escape of bowel contents by non-crushing forceps temporarily applied somewhat more remotely.

Nothing appears to be gained in the long run by the use of the various elaborate methods designed to achieve an aseptic anastomosis. The instruments are often less adaptable to suturing at an awkward depth and they usually introduce a danger of

reactionary hæmorrhage, which is absent from the ordinary two-layer anastomosis. Lastly, unsatisfactory results in resection of the colon should not be attributed to the trivial local contamination with intestinal contents which may occur. Peritonitis and a fatal issue are not the result of local contamination but are due to two factors :—

(1) Early peritonitis is due to failure to provide an adequate method of decompressing the bowel, i.e. an imperfect cæcostomy, or failure to provide an extra safeguard in the form of a tube passed up from the anus, in dealing with resections low down in the sigmoid or pelvic colon.

(2) Late peritonitis is the consequence of sloughing at the suture line from failure to conserve blood supply to the bowel ends. Even this failure can be safeguarded by providing drainage in all cases down to the site of anastomosis—in nearly half of such cases a fæcal fistula of lesser or greater importance develops, but in over 80% of cases it heals within three weeks, and not once in this series did it fail to close entirely spontaneously.

There is a tendency in American and continental clinics to attach much importance to the use of thread or silk sutures in large bowel anastomosis, but it is fallacious to assume that these materials have any advantage over fine catgut introduced with an atraumatic needle. Failure of union may be due to faulty *methods* of suture, but not to the suture material itself—far more often it is attributable to damage to the blood supply. It is one of the great virtues of the terminal crushing clamp that after removing and trimming of the crushed tissue, the quality of the blood supply to the bowel ends is revealed, and should any defect exist, the position can be remedied at once by readjusting the line of the resection. There seems little doubt that two layers of continuous sutures are adequate—the outer seromuscular, the inner through-and-through and hæmostatic, but extra safety is secured by bringing any reflected tags of omentum, &c., back over the suture line with interrupted sutures.

These principles of axial anastomosis can be applied to certain growths of the recto-sigmoid, lying immediately above the peritoneal reflection, particularly in thin subjects. There is far less danger of serious infection than has been supposed, and in elderly people the scope of the extirpation is ample and the technique not prohibitively difficult in the high Trendelenburg position. The risk in suitable cases is no greater than with Hartmann's method and, of course, is infinitely less than that with the abdomino-perineal extirpation.

In conclusion : The best results in the surgical treatment of carcinoma coli are to be expected only if judgment be exercised in the choice of the appropriate operative procedure. It would be as erroneous to perform, as a routine, axial anastomoses in one or more stages, as it would be to condemn every patient to the prolonged miseries associated with the Mikulicz-Paul method and its numerous modifications. Finally, the very elderly patient often does well and survives into the eighties or nineties after resections of the colon which, according to strict surgical pathology, are inadequate and theoretically unjustifiable.

Discussion.—Mr. LIONEL NORBURY said that he would like to put in a word for the Mikulicz-Paul operation. He considered it to be a safe and quite efficacious method for the removal of most growths involving the iliac and pelvic portions of the colon. It was especially indicated in cases with some degree of obstruction in which the colon above the growth was distended ; it was also specially indicated for elderly patients. It could not be employed for growths involving the lower portion of the pelvic colon, since it was essential to deliver the growth and to have an adequate length of bowel below the lesion to bring to the surface after removal of the growth.

It was not necessary to remove a long portion of bowel below the growth since lymphatic spread below the lesion was the exception unless all lymphatic channels draining the growth were blocked, and in such cases the growth would be inoperable.

The removal of 2 in. of bowel below the growth with its associated mesentery was quite sufficient to include any lymphatic spread in a downward direction. By suitable mobilization

it was possible to remove 4 to 6 in. of colon above the lesion, with its mesentery, and still bring the upper end of the divided bowel to the surface.

The length of stay in hospital need not be materially prolonged, since it was unnecessary to wait many days before applying the enterotome. This could be done within the first two or three days and the continuity of the bowel restored within six or seven days after its application. Extraperitoneal closure of the colostomy could then be accomplished without delay.

He (Mr. Norbury) strongly advised the Mikulicz-Paul operation when the surgeon was in any doubt as to the advisability or safety of primary anastomosis after resection. A preliminary cæcostomy did not always drain the colon below the splenic flexure and so primary anastomosis after resection in such cases was not devoid of risk.

Professor R. E. KELLY said that he supported Mr. Joll in advocating end-to-end anastomosis in cases of growths in the right side of the colon. When acute obstruction was not present, but the stricture had existed for some time, the diameter of the ileum approached that of the transverse colon and an end-to-end anastomosis was generally easily and safely accomplished without difficulty. Even if the ileum was smaller than the transverse colon the cut end could easily be enlarged by slitting the requisite distance along the anti-mesenteric border. Bursting strain on the anastomosis could always be obviated by the insertion of a catheter a few inches proximal to the anastomosis on the right side and a small Paul's tube on the left side.

Post-Anal so-called "Pilonidal" Sinus

By A. HEDLEY WHYTE, M.S.

A CYST or a sinus lined in part by stratified squamous epithelium and in part by granulation tissue, which may contain hair, is situated in the mid-line just above the coccyx, does not communicate with the rectum, and usually is not recognized until after puberty, may be given one of a variety of names. In this country we commonly use the terms "post-anal dermoid", "coccygeal and sacro-coccygeal cysts and sinuses", and also "sinuses in the sacro-coccygeal region". In America the commonest title used is "pilonidal cyst", although the adjectives "pilous" and "pilodermal" are frequently noted. None of these names is entirely satisfactory.

For a considerable time hairy nests in the sacro-coccygeal region have been described in American literature. Lynn Wilson and Ferguson and Mecray quote A. W. Anderson of Gray, Maine, as having first described the condition in 1847 in the *Boston Medical and Surgical Journal*. His patient was a young man, aged 21 years, who said he had "a scrofulous sore on his back which he believed would use him up". From the "ulcer" Dr. Anderson extracted hair.

Twenty years later Warren writes about "pilonidal cysts", although Hodges is usually given the credit for coining the word "pilonidal" in 1882.

For a considerable time nothing is noticed in the literature, although Goodsall and Miles in 1900 devote a chapter in their book to a condition which they call "sinus over the sacrum or coccyx". They do not recognize its true nature, attributing eight of their cases to trauma. However, during the last fifteen years there have been many articles written in American journals and in this country. Lockhart-Mummery in 1921 wrote about the congenital origin of these cysts, and in 1929 published a photomicrograph in the *Proceedings*. Gabriel, in his excellent book, and Newell, in an informative article, give interesting accounts of their cases.

In a typical case a young adult in the twenties notices a lump forming in the sacro-coccygeal region. It may follow, or be in some way associated with, an accident. It may cause very little inconvenience for some time, or may quickly become painful, enlarge, redden, fluctuate, and discharge. The discharge is at first either watery or purulent, and if first watery, soon becomes purulent and frequently foul-smelling. After some time the sinus heals, and may remain healed for a considerable time before

there is a recurrence. A doctor is consulted and the part is fomented or incised. Later the patient visits hospital and the condition is diagnosed because of the thickening in the mid-line over the sacro-coccygeal joint, one or more dimples, and discharge coming from one of these. At one side there is frequently a secondary sinus opening. A probe passed into a dimple passes upwards for a short distance towards the sacrum and may come out of the secondary sinus opening. There is always a healthy area between the induration and the anus, and the condition need never be mistaken for a peri-anal or ischio-rectal abscess or fistula-in-ano. Small hairs rarely may be noted extruding from a dimple or sinus. The patient is frequently of the dark, hairy, well-nourished type.

Ætiology.—There is considerable discussion as to whether the sinuses are definitely congenital and derived from ano-coccygeal bodies, neural or neurenteric remnants, or are inclusion cysts resulting from faulty coalescence of the skin in the mid-line (Bland-Sutton, J., 1922) or are definitely true sequestration dermoids.

Zieman, in an informative recent article, favours the theory of the neurogenic origin of these cases. He says the sinuses may be single, with one external opening or many, or the sinus may extend unilaterally or bilaterally, up into the groin or down into the leg. Inwardly it may communicate with the prevertebral fascia, extend directly through and into the vertebral canal, even becoming continuous with the periosteum, the dural linings, or the arachnoid. Besides sweat-glands, hair-follicles, and hair in the cyst, neural buds with ends of nerve-tissue have been reported and observed.

Stone is quite alone in thinking that these cysts are analogous to the preen glands found in a great many species of birds.

For a considerable time in the American literature it was accepted that negroes were immune to pilonidal cysts and sinuses, though why that should be is rather difficult to explain, as in so many of the cases seen, the patients are of the dark swarthy type. However, in April last year, Saleeby and McCarthy report a case in a coloured boy of 18, and quote five others.

Sex incidence.—Both sexes are affected by these cysts, but which sex is the more commonly affected is a point not yet settled. Goodsall and Miles quote 17 cases, eight in women and nine in men. Newell's cases were all in females. Gabriel says "males are more often affected than females". Owen says that less than 10% occur in females, and Ferguson records 42 cases, 37 of which were in males, and an extraordinary number of which were medical students. Ravdin and Johnston have collected 505 cases from the literature of which 75% were in males.

Of the 45 cases treated at the Royal Victoria Infirmary, Newcastle-upon-Tyne, since 1930, 32 were in females.

Treatment.—Some form of excision is the most likely form of treatment to be followed by a permanent cure. The ideal to be aimed at in all cases is radical excision. This may leave too large an area to be closed by sutures, and the area may be packed and allowed to granulate, or a partial suture with drainage may be carried out.

The treatment ultimately adopted in most of the cases mentioned above was radical excision. I make an elliptical incision, removing the mid-line area as appears necessary, making sure to go well wide of any dimples and to include any secondary openings. The skin edges are undermined and the normal fatty tissue cut through, until the coccyx is exposed distally and the fascia over the gluteal muscles laterally. The tissue is excised proximally, keeping well down on to the periosteum over the sacrum, and the cyst and infected surroundings are removed *en bloc*. I have not needed to inject with methylene blue to define the extent of the condition. The resulting raw area is made quite dry by thorough hæmostasis, washed out with spirit, and smeared over with a thin layer of Rutherford Morison's Bipp. Deep catgut sutures are inserted if there is any possibility of the subcutaneous fat being approximated; and the skin is drawn together by vertical mattress sutures—more

Bipp is smeared on the wound, which is then covered with a layer of boracic powder.

The patient is encouraged to lie on his back, and this extra pressure further helps obliteration of the space and prevents collection of serum.

The bowels are not moved for six days, and then by enema. By that time, half the stitches can be removed, the wound is either healed or nearly so, and the remainder of the stitches are removed on the ninth day.

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Mr. R. L. NEWELL: In 1935, in the *British Journal of Surgery*, I described 11 cases of coccygeal sinus. Since then I have had under my care 62 cases—13 male and 49 female. Two occurred in newborn babies, but gave rise to no symptoms. The remainder have been completely cured by a radical excision. I am now able to obtain primary union in a larger percentage of cases, owing to the fact that I avoid operating in the acute stage, preferring to allow the abscess to settle, or even making a small incision to allow drainage before performing the radical operation. There has been no mortality in my series. In one case a lung abscess developed, but fortunately the patient completely recovered. Another surgeon has reported to me that in one of his cases the patient died from septicæmia following operation.

The condition is a dermoid sinus. The primary sinus is lined by tissue indistinguishable from skin, and is always situated in the middle line. If a radical excision of the skin of the middle line, plus the subcutaneous tissue down to the coccyx, is carried out, there will be no recurrence. The incidence is by no means small. During the three years 1934-35-36, 46 cases were operated upon at the Manchester Royal Infirmary.

JOINT DISCUSSION No. 4

Section of Radiology with Section of Obstetrics and Gynæcology

Chairman—R. E. ROBERTS, M.D. (President of the Section of Radiology)

[*January* 21, 1938]

DISCUSSION ON RADIOTHERAPY IN NON-MALIGNANT GYNÆCOLOGICAL DISORDERS

Dr. W. M. Levitt: *Fibromyomata.*—There are not many non-malignant conditions of the uterus in which radiotherapy may be indicated, but at least one of these is of great importance. I refer to fibromyoma, and it is time that an attempt was made to formulate with some degree of precision the indications and contra-indications to radiotherapy in this condition.

It has been known for over thirty years that X-rays can give very good results in the treatment of fibroids. The bleeding soon ceases, and the fibroid gradually reduces in size over a long period, even to total clinical disappearance. Béclère, in an early series of cases, reported symptomatic relief, with reduction in the size of the fibroid, in over 90% of cases, with total disappearance of the tumour to clinical examination in 28%; while Seitz and Wintz, in a later series, reported similar results with clinically total disappearance of the tumour in 32%. Both these series were treated by X-rays, but the results of radium therapy in expert hands are probably not very different from those of X-ray therapy. With modern X-ray therapeutic technique complete symptomatic relief is obtained in nearly 100% of cases, although with fibroids of any size a symptomless remnant of the tumour is likely to remain. The results of radium therapy have not, perhaps, quite the same constancy as those of X-ray therapy, but in other respects they are similar.

The mode of action of radiations on these growths is not properly understood, but there is no doubt that their main action is through the ovaries. This is shown by the fact that consistently good results are only obtained when sterilization has been produced, and also by the fact that sterilization alone, without direct irradiation of the fibroid, appears to be equally effective. When radium is used in a fibroid of any size, only an infinitesimal amount of radiation can reach the peripheral portions of the fibroids; yet, as I have said, there is probably little to choose between the results of X-ray therapy and those of radium therapy. That *some* direct effect is produced on the fibroid, however, is shown by the fact that reduction in size of a fibroid has sometimes been observed after an irradiation which stops short of sterilization.

This consideration of the mode of action of radiations indicates at once the reason why radiation therapy, although almost uniformly successful in its results in this condition, is far from being a universally applicable method of treatment; in fact its use is at once excluded in all cases occurring during the child-bearing age, at any

rate, before the age of 40. Nor is the fact that the myomatous condition may be so extensive as to preclude any possibility of a successful pregnancy to be regarded as sufficient justification for the use of radiations in preference to surgery in a young woman. The abolition of the internal secretion of the ovary—which is entailed by the treatment—is followed by all the changes of the menopause, and the undesirability of producing these in a young woman needs no stressing here. I have taken the age of 40 as a convenient dividing line, but in practice some elasticity is necessary. The general impression given by the patient of what might be termed her " physiological or ovarian age " is a fairly reliable guide. Some women at the age of 40 are beginning to look elderly ; these will probably have a fairly early menopause, and are suitable subjects for radiation treatment. On the other hand, one would hesitate to sterilize a woman of even 42 or 43, whose " physiological age " appeared to be a good deal younger.

In patients over the age of 40, with the above reservations, I submit that radiation therapy is the treatment of choice in the great majority of cases. It is simple and safe in its application and certain in its results, while the alternative is a major operation. Hæmorrhage is completely relieved within from three to seven weeks, i.e. after one or two periods. Rarely does this interval extend to a third period. It will be seen that at the outside limit relief is obtained in considerably less time than that required for convalescence from a major operation and, in the case of X-ray treatment, without the patient even having to take to her bed.

We next have to consider the contra-indications to radiation therapy in fibroids. These affect only a small minority of cases. The first is any acute complication, such as impaction of the tumour, causing interference with micturition. Secondly, any fibroid which is so large as to cause pressure symptoms contra-indicates radiotherapy. Both these contra-indications arise, not from any danger inherent in the treatment, but merely from the fact that the retrogression of the tumour following radiation therapy is a slow process, and in such cases delay is obviously to be avoided. Any clinical evidence of degeneration in a fibroid is a contra-indication to irradiation. Finally, it is frequently stated that submucous fibroids contra-indicate radiation therapy, but I doubt whether this is really the case.

The advantages of X-rays over radium are that the treatment is applied with much greater comfort to the patient ; no hospitalization and no anæsthetic are necessary, and an intra-uterine procedure is avoided. The mortality is *nil*. A further disadvantage of radium is that the dosage to the mucous membrane of the uterus is very high compared with the dosage required to the ovaries, and this may result in changes in the mucous membrane which may lead to great discomfort should menstruation become re-established. Nowadays there is nothing to choose in the time required to carry out the treatment in each case, as the X-ray treatment requires only a week to complete. Repeated series of treatments over a long period are no longer practised. It is true, however, that where an anæsthetic, and possibly dilatation of the cervix, have already been rendered necessary as a diagnostic procedure, the insertion of a radium tube into the uterus imposes little or no extra inconvenience either to the patient or to the operator, and the patient is subsequently saved the necessity for further treatment.

High-voltage X-rays are invariably used and treatment is applied daily, usually for six applications. It is possible in women over the age of 30 to produce sterilization by a planned irradiation carried out in one day. The great disadvantage of this, however, is that considerable X-ray sickness may follow the treatment. When the treatment is carried out over a period of six days, however, there are little or no after-effects.

Endometriosis.—Next in importance after fibroids, as an indication for radiation therapy, is endometriosis in many of its various manifestations.

We have to consider in the treatment of this condition too, whether the tumour itself can be destroyed by radiations applied directly to it, or whether, as in the case of fibroids, sterilization is also necessary. From the cases that have been reported in which radiation therapy has been applied, it would appear that sterilization either by surgery or by radiations is unavoidable, except in those cases in which a complete and clear excision of the lesion is possible. My own experience concerns one case only, and observation of that case, a recent one, has shown that the lesion itself has not completely responded to very large local doses of X-rays, although complete symptomatic relief has been obtained by sterilization. It is possible that interstitial radium therapy may produce better results than local X-rays. Sterilization may perhaps be avoided by this form of treatment in certain cases, especially when the disease is situated in the recto-vaginal septum, and the radium is thus at a safe distance from the ovaries.

When the decision to produce an artificial menopause has been taken, radiation treatment offers an advantage over surgery, in that below the age of 34 or 35 a temporary sterilization can be produced, lasting for two years or so. Over that age one cannot be certain that any sterilization will be temporary, and over the age of 40 the sterilization is almost invariably permanent, even with minimal dosage. As to the choice between X-rays and radium, again I consider that X-rays are preferable, not only for the reasons given when discussing fibroids, but also because the irradiation can be so planned as to include the lesion or lesions, thus increasing the chance of eradicating the disease.

To sum up: It is unlikely that the lesion peculiar to endometriosis can be eradicated by local radiation treatment alone, and sterilization is therefore called for when a clear excision is impossible. This sterilization is better effected by radiation therapy than by surgery, and of the two methods of radiation therapy X-rays are again preferable.

Functional hæmorrhages.—For irregular functional hæmorrhage at or near the menopause, radiation treatment is the treatment of choice, but the use of this form of treatment at earlier ages is subject to the same limitations as those in the case of fibroids. Only occasionally must these rules be relaxed. For example, in the extremely grave hæmorrhages that may occur at puberty, temporary X-ray sterilization is obviously preferable to hysterectomy.

Chronic inflammatory conditions.—Abroad—especially in Germany—certain chronic inflammatory conditions affecting the uterus are frequently treated by radiation therapy. They are usually part of a widespread pelvic inflammation. The commonest of these are tuberculosis, actinomycosis, and gonococcal infections. They are treated by small doses of X-rays applied at weekly intervals over a long period. The treatment is kept well short of the sterilization dose, and good results are claimed for the method. I saw some cases of tuberculosis that had been successfully treated by Martius, when I visited him in Bonn some years ago, and when I was in Würzburg I saw several cases of chronic gonococcal infection which appeared to have benefited from this form of treatment.

There is one matter to which I would like to refer in conclusion, and that is the question of the possibility of the production of malignant disease by X-ray treatment. One is sometimes asked: Is there not a danger that the X-ray or radium treatment may set up malignant changes? The answer is that malignant disease can only be produced by repeated small doses of radiation, applied over a long period (years). Such conditions are only fulfilled in the case of radiologists and others handling X-rays or radium for treatment, or for experimental or trade purposes. It is doubtful whether malignant disease can be produced in any organ apart from the skin, and it is quite certain that there is no danger of the production of malignant changes by any therapeutic irradiation carried out on modern lines.

Dr. J. F. Bromley : The subjects for consideration in this contribution to the discussion are pain and hæmorrhage (including irregularities of menstruation). Its scope excludes uterine conditions, but there are certain dysfunctions of other organs which are manifested by pelvic or particularly uterine symptoms and which may be conveniently studied. Menstruation is the culmination of a period of activity of the endometrium (a proliferative phase followed by a secretory phase) which is governed by changes in the ovary (follicle growth, rupture, and formation of the corpus luteum), the whole process being preparatory for the reception of a fertilized ovum in the uterus.

It is also accepted that the activity of the ovaries, and through them that of other reproductive organs, is maintained and controlled by the anterior lobe of the pituitary. The hormones which have been ascribed to the pituitary, and which appear to be within the scope of this paper are (1) somatotropic ; (2) gonadotropic ; (3) thyrotropic—including parathyrotropic ; (4) adrenotropic ; (5) mammotropic.

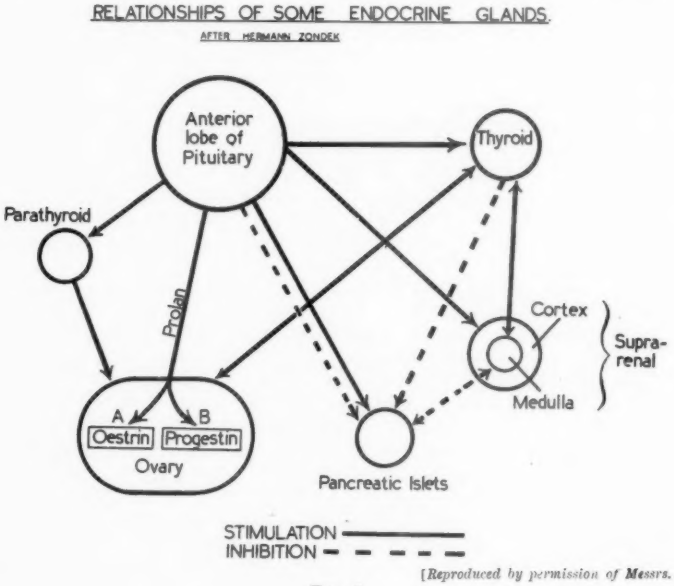

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FIG. 1.

The above diagram (fig. 1), modified from Hermann Zondek's book (Zondek, 1935) serves to illustrate such of these interrelationships as are of particular interest to us.

The somatotropic or growth hormone (T. J. Putnam, 1929) need not detain us. We may recall that Marie (1886) described acromegaly " which was usually accompanied by an hypophyseal tumour " and that Evans and Long (1922) caused gigantism in normal rats by daily intraperitoneal injections of the anterior pituitary of the ox. A disease due to deficiency of this hormone has been described under the name of " akromikrie " (Brugsch, 1927), while the clinical and radiological appearances of acromegaly and gigantism, which result from hypersecretion, are well known. It has been shown that in acromegaly the pituitary enlargement is mainly composed of eosinophilic cells (Fischer, 1910). The condition is occasionally associated

with goitre (excess of thyrotropic hormone), and in women amenorrhœa is almost constant, together with loss of libido and the power of conception. Hermann Zondek (1935) records a case in which the onset of acromegalic symptoms began three months after a total extirpation of the uterus and ovaries ; five years later the patient showed the full stigmata of acromegaly. Béclère (1909) first—as far as I am aware—drew attention to the great value of X-ray treatment in this condition, and others (F. Schäfer, 1930, and J. Feger, 1921) have written confirming this. Hermann Zondek indeed (1935) states that irradiation is " the most promising method of treating acromegaly ", and mentions the high case mortality of all surgical methods from complicating meningitis or cerebral abscess. In particular, X-ray therapy gives striking relief from the unbearable headaches which are such a feature of the disease, while at the same time the visual fields, which may have been contracted, are extended.

The secretion of a gonadotropic hormone by the anterior pituitary has been demonstrated by Evans and Long (1922), Bernard Zondek and Aschheim (1926), Smith and Engle (1927), and other workers too numerous to mention. Whether two separate hormones, one " follicle stimulating " and the other " luteinizing ", exist, or whether the two functions are the result of different quantitative stimulation by the same hormone, is still questionable, but it may be accepted that the ovaries are necessary intermediaries for certain anterior pituitary effects, and that gonad-stimulating hormones, associated with the anterior pituitary, may be demonstrated in the urine in a variety of conditions. For example, it has been shown that women castrated surgically, or by X-rays (Lassen and Brandstrup), excrete in their urine a large quantity of " gonadotropic " substance, and that after artificial menopause œstrogenic substance is absent from blood and urine, but that the " gonadotropic " factor may be found increased as early as the tenth day after the operation. More usually the increase develops after eight weeks and may persist indefinitely (C. F. Fluhmann, 1931). Fluhmann has also pointed out (1929) that the physiological menopause is associated with a great increase in the " gonadotropic " factor in the blood, and further it appears that this " gonadotropic " principle in the urine of post-menopausal or castrate females, and the " follicle-stimulating " principle of the anterior pituitary are identical. Still other experiments (E. T. Engle, 1928) show that after removal of the ovaries there is an increase in the power of the anterior pituitary to stimulate ovarian function, and that this increased " gonadotropic " activity can be countered by the exhibition of œstrin. This is interpreted by Moore and Price (1932) to indicate that the anterior pituitary stimulates the gonads to secrete a specific hormone, which in turn depresses the gonad-stimulating anterior pituitary activity.

I need hardly dwell on the importance to radiologists of the above experiments, which make it clear that at many periods of the life-cycle an enormous hormone output, with all its possible effects on the rest of the endocrine system, occurs from a gland which can easily be irradiated with the minimal inconvenience to the patient herself and without fear of injuring surrounding structures. Thomson (1932) suggested that the occurrence of particularly severe menstrual headaches in certain patients might be due to pituitary swelling in the presence of a sella turcica which was either bridged by bone or by a membranous " diaphragma sellæ " (since he found that in the great majority of post-mortem patients the diaphragma sellæ does not exist as a diaphragm at all, and only very rarely can it be truly said that it completely roofs in the pituitary fossa). On p. 48 is a skiagram from a case seen this week. The patient, aged 31, has, since an attack of influenza ten years ago, suffered from epileptiform attacks associated with the menstrual period. The sella in the lateral view shows bridging of the space between anterior and posterior clinoids (fig. 2).

Before mentioning X-ray treatment to the pituitary for this and for menopausal complications, let me state definitely that I shall suppose that X-rays—even in small doses—cause entirely depressing (as opposed to stimulating) effects. Experiments of

real clinical value on this important question are difficult to carry out—my own attempts with irradiation of the ovaries of rabbits and mice are entirely inconclusive—but a most interesting paper by Svensen Chrom (1937) last year, reports the effects of small doses (10 to 75 röntgens) of X-rays on reticulo-endothelial tissues. No experimental evidence of stimulation could be shown. Previous work by the same author (1935) showed only a decrease in functional capacity as a result of larger doses of irradiation. Moreover, I have yet to meet the radiologist who will admit that his treatment has had a stimulating effect on a malignant growth which has failed to respond to radiation, so that as a profession we must not try to " have it both ways "—to claim a purely depressant effect in malignant disease and an occasional stimulating effect in non-malignant therapy.

Opinions differ about the interpretation of certain large clear " castration cells " in the anterior pituitary, following removal of the gonads (Ellison and Wolfe, 1934),

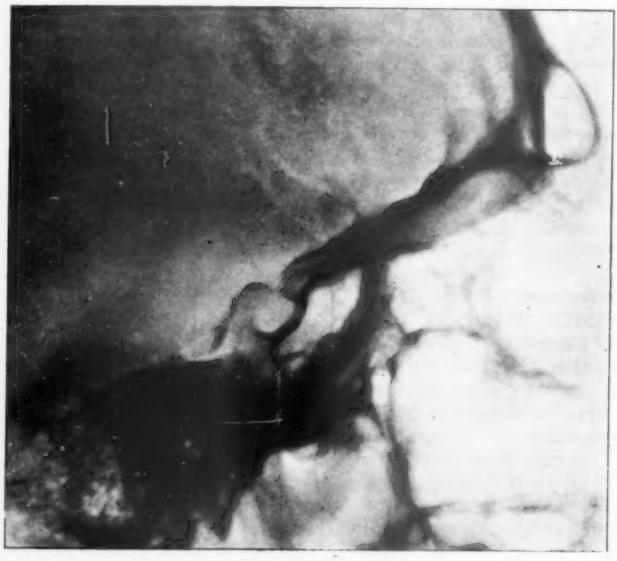

FIG. 2.

but castration in men is associated with increase of basophilic and chromophobe cells of the anterior pituitary (Biggart, 1934) and the evidence already quoted leaves no doubt that either physiological or artificial menopause is associated with considerable pituitary over-activity. In menopausal complaints, therefore (associated either with physiological or with artificial menopause) the application of X-rays to the pituitary seems to be a reasonable proceeding and is justified by experience; Collins, Menville and Thomas (1936) and Bortini (1936) report success in 85% and 80% of their patients. A case of my own may be of interest :—

R. C., aged 24, unmarried, was sent to the Radiation Therapy Department in May 1936 with the following history: In June 1934 hysterectomy and double salpingo-oophorectomy had been performed for tuberculous disease. Since then she had complained of severe menopausal symptoms, flushings every day, and almost continual pain in the head, which periodically became completely incapacitating and was associated with nausea, but no actual vomiting. No relief followed the exhibition of monthly doses of œstroform 10,000 units.

Prolan estimation of the urine showed 40 mouse units per litre (a very considerable excess over an uncomplicated "non-pregnant" specimen). A course of 2,000 röntgens was given to the pituitary in 12 sessions over thirty days by two lateral ports of entry (factors 200 K.V. constant tension, 1·65 mm. Cu filtration, fields 6 × 8 × 40 cm., intensity 23 röntgens per minute), and was followed by a very striking improvement. The headaches disappeared, and the flushings were greatly diminished. In November 1936 the headaches returned, and a further course of 2,000 röntgens was given in 12 sessions over forty-one days, followed by the same remarkable improvement.

Other activities of the anterior pituitary which have a particular interest to the gynæcologist and the radiologist are those which involve stimulation of the adrenals, thyroid, and parathyroid. The relationships between the anterior pituitary and the adrenal cortex were reviewed in great detail by Shumacker and Firor in 1934; there would seem to be no doubt from both experimental and clinical evidence that the relationship between these endocrine glands is a close one (Anselmino, Hoffmann, and Herold, 1934, and J. B. Collip, E. M. Anderson, and D. L. Thompson, 1933). The association of hyperplastic adreno-cortical tumours with clinical signs of virilism or pubertas præcox is well known, but as Cameron points out (1936) the development in adult males may in some cases be towards the female type, while in the female the predominating change is towards maleness. Cushing (1930 and 1932) has shown that a number of patients with symptoms suggesting such tumours, have been found at autopsy to be suffering not from a primary adreno-cortical tumour, but from an adenoma of the basophil cells of the anterior pituitary, and he has suggested that a hyperplastic anterior basophilic pituitary lesion may be the true explanation of certain syndromes hitherto called "polyglandular" and supposed to be cortico-adrenal in origin, the features of which may be summarized as follows:—

The patients are usually young adults (one patient, however, reported by Cushing and later verified by autopsy, was aged 44 when she came under observation). Amenorrhœa in the female, with corresponding impotence in the male, is an early feature. There is hypertrichosis of the face and trunk in females and adolescent males, with the reverse in adult males. Adiposity in face, neck, and trunk, is common, though not invariable; usually it comes on quite rapidly. The skin is dry and coarse and may be dusky. Dark striæ are frequently seen on the abdomen and legs. Women appear to be affected more commonly than men, but this may be because the symptoms of amenorrhœa, adiposity, and heterosexual hirsutes, cause more discomfort in the female than the corresponding ones do in the male. Other symptoms, which have been described, though not invariably present, are thirst, polyuria, aching pains in the eye, thinning of the hair of the scalp, raised blood-pressure (common), hyperglycæmia, and a peculiar susceptibility to infections such as multiple cutaneous ulcers, abscesses, erysipelas, and pulmonary complications. Most of the patients become round-shouldered and kyphotic, sometimes so much so as actually to lose height; this feature is found to be associated with decalcification of the bones, particularly the spine and skull. This decalcification may be of a rather characteristic "mottled" appearance, and flattening and compression of the vertebral bodies, especially in the mid-dorsal region, are seen. It has been shown experimentally (Anselmino, Hoffmann, and Herold, 1934) that hypertrophy of the parathyroid may follow the injection of anterior pituitary extracts ("parathyrotropic" hormone), and possibly this might account for the bony atrophy, and for the increased output of calcium in the urine and fæces, such as were found by J. C. Aub in one of Cushing's cases (1932). In 1936 I reported a series of six patients, five females and one male, whose symptoms seemed to correspond with the presence of varying degrees of basophilic hyperpituitarism and which were relieved by röntgen therapy, when other methods had been less successful. One very typical example was in a male who had undergone an exploratory operation by which the existence of an adrenal tumour had been disproved. A severe degree of mental depression was noted in most of

these patients, and the improvement with regard to this symptom alone, under X-ray treatment, was very striking. Menstruation was re-established in three out of five of the patients, and a fourth menstruated occasionally after twelve months' previous amenorrhœa. Cushing (1932, 1933, and 1937), Tchaperoff (1936), Jamin (1934), and others have reported several of these patients who have benefited strikingly from X-radiation of the pituitary. The following two additional cases treated in my Department emphasize certain of these points :—

D. R., aged 37, single, was referred to the Radiation Therapy Department of the General Hospital, Birmingham, in October 1936, by Dr. Rupert Collins, Honorary Physician to the Cheltenham Hospital, where the patient had also been seen by Dr. Mucklow, a member of the Section of Radiology. She was admitted under the care of Dr. A. P. Thomson, with a clinical history as follows: At the age of 22 she began to grow a moustache and beard which twelve

FIG 3.

years later was as thick as that of an ordinary male ; the pubic hair had extended upwards in a typically male distribution. When examined by Dr. Collins in 1932 she weighed nearly 17 st. She was much distressed by her appearance and was subject to violent passions. The external genitalia appeared normal. X-ray examination showed some increase in size of the left renal shadow as compared to the right, and a doubtful irregularity of the upper pole. Laparotomy was performed in November, 1933. The left suprarenal was slightly but uniformly enlarged and was removed. Careful microscopical examination afterwards showed no evidence of any abnormal growth. There was some improvement after the operation, but by December 1935 the growth of hair on the face had become so troublesome that the patient submitted to epilation by surface radium applications. In October 1936 she was admitted to the General Hospital. The growth of facial hair was very thick and

extensive, including a well-formed beard and moustache. She was greatly depressed and declared her willingness to undergo any form of treatment. Various investigations were carried out, including X-ray examination of the skull and other bones. There was no apparent enlargement of the sella turcica, but the calcium content of the bones, judged by their radiographic appearance, was poor, and the middle and lower dorsal spine showed a curious combination of compression, erosion of articular surfaces, and hypertrophic osteo-arthritis (fig. 3). X-ray treatment was begun in October 1936 and 2,260 röntgens were delivered to the pituitary by two ports in 16 sessions over twenty-one days (Factors: 200 K.V., constant tension, thoraeus filter, 300 "r" per session, intensity 25 "r" per minute, dose calculated at pituitary, back-scatter included). By the end of February 1937 there was a striking improvement; the patient was cheerful and bright, and the hirsuties was much less. A second course, 1,500 röntgens to the pituitary, was then given by 3 ports in 14 sessions. A third course of 1,700 röntgens was given to the pituitary in May 1937 in 12 sessions over sixteen days. In December 1937 I received the following report from Dr. Collins, in answer to an inquiry: "I think you have been very successful. The hirsuties is much less, and the patient seems mentally brighter".

Dr. Collins drew my attention to a description by Charles, in *Medical Annual* (1932), of a case of adrenal virilism which bears a curious resemblance to this one, and in which the same question arises as to the cause, whether basophil pituitary or primary adreno-cortical tumour.

I am indebted to Professor K. D. Wilkinson for permission to refer to the next case. The treatment has been instituted so recently that it is not permissible to refer to results, but the case illustrates very well some points in the syndrome which I am describing.

K.B., aged 14, was admitted to the General Hospital in October 1937, complaining of headaches, loss of sleep, and gain in weight. Her family doctor, Dr. Vaughan of Coventry, had examined her and detected the typical striations on the skin of the abdomen and legs. Most of the symptoms were attributed to the shock of her father's death about two years previously. Her face became so much fatter that her friends "began to think she must have toothache all the time", but soon the deposition of fat involved the body and arms.

On examination.—A bright intelligent girl, rather of the hirsute type (hair low at the temples, but no true masculinity of distribution. Secondary sexual characteristics not unduly retarded (has menstruated twice). Cushing has referred to the typical "moon-face" in these cases; the patient already showed this. On the trunk, upper arms and thighs were numerous purplish striæ (fig. 4). The basal metabolic rate was 40% below normal, but sugar tolerance was normal. An X-ray film showed a normal bony sella turcica, but the middle dorsal spine showed impaired calcium content with commencing compression of the 8th, and an irregular articular surface of the 10th which is quite incompatible with the normal in a patient of this age (fig. 5). The red blood-cell count was 5,490,000 (Cushing records a count of over 5 millions in five out of nine cases in which blood-counts were estimated). The skin was dry and pigmented, especially the extremities. Cushing also refers to insomnia, which was one of this patient's earlier complaints.

Although Wirz (1932) has shown that in the human subject fewer hormones are found before sexual maturity, the whole clinical picture of the patient in the above case corresponds so closely to Cushing's that I feel certain we are justified in treating her first by the application of X-rays to the pituitary. She is already much less troubled by headache.

It is scarcely necessary to emphasize the need for close co-operation with the gynæcologist and the physician in the radiation treatment of excessive uterine hæmorrhage and for careful preliminary consideration of the exact cause. (Beckwith Whitehouse, 1935, has recorded a fatal menstrual hæmorrhage from the uterus which occurred in a patient suffering from lymphatic leukæmia.) The clinical factors involving dosage, and the appropriate endocrine gland to be treated, must also be considered. The radiologist may conveniently adopt the accepted gynæcological

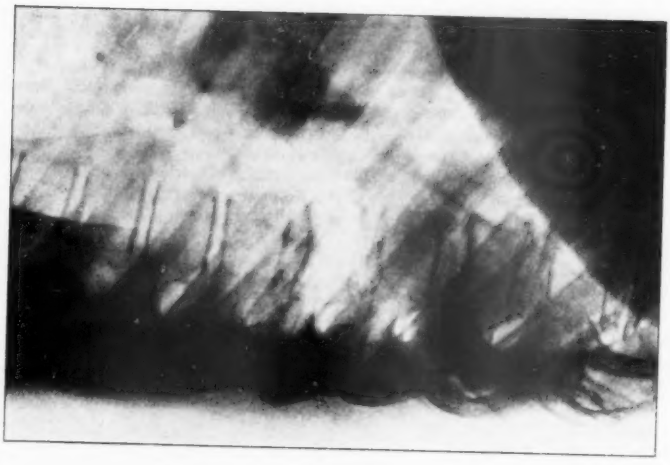

FIG. 5

FIG. 4.

classification of uterine hæmorrhage. Two types may be mentioned here, as within the scope of my paper:

(1) Epimenorrhœa (abnormally frequent menstrual periods) should be regarded as a clinical manifestation of imperfect balance between the endocrine organs, and therefore to be expected at puberty and at the menopause. Associated with epimenorrhœa may be signs of excessive thyroid activity which the radiologist may be called upon to treat. The ovaries, according to W. Shaw (quoted by Sir Beckwith Whitehouse and Eden and Lockyer, p. 436), often show evidences of irregular and too frequent ovulation, with the presence of more than one corpus luteum. The uterine endometrium is hyperæmic and œdematous, but without indications of inflammatory change. In older patients the obvious treatment is to proceed to the arrest of ovarian function by radiation—a safe and radio-simple exercise in radiotherapeutics. In younger patients a temporary amenorrhœa lasting from six months to three years may be established by moderate irradiation (Levitt, 1932), and the anterior pituitary should also be irradiated at the same time, in view of its relationship and to modify possible " menopausal " disturbances. An extensive literature exists, dealing with the temporary amenorrhœa which can be induced by radiation, particularly with reference to its influence on children born at a later date. Probably, the risk of pregnancy should be avoided in the first few months after the application of the temporarily sterilizing dose (Wintz, 1932), but conception which takes place after the end of the temporary amenorrhœa (" late conception ") is apparently not associated with any risk of abnormality in the child.

(2) Menorrhagia—or true excessive quantity of menstrual lochia—is frequently caused by a hypersecretion of sex hormones, and may be associated with evidence of abnormal ovarian, thyroid, or pituitary, activity. In such cases, the advice of the gynæcologist and physician can be particularly helpful. Not infrequently, of course, one is driven to direct irradiation of the ovaries to check the hæmorrhage, but I believe that it is good practice to accomplish the relief of these patients with minimal doses, particularly to ovarian tissue, so that a careful investigation for indications of endocrine disturbance in other parts of the body will often help the radiologist to distribute his dosage more adequately over the endocrine system. The interesting form of menorrhagia known to gynæcologists as " metropathia hæmorrhagica " is associated with persistence of ripening follicles in the ovary—which, however, fail to rupture, with subsequent absence of the luteal hormone. Gynæcologists are accustomed in such cases to treat the symptom of hæmorrhage with great success by introducing a radium tube into the uterus for a short period. I have often wondered whether the relief of symptoms may not be due in part to depression of the œstrogenic function of the ovary, since it is accepted that a primary factor in the production of the condition is ovarian. If this is so, it would be an argument in favour of treatment by X-rays to the ovaries.

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Mr. Leonard Phillips: My remarks are based upon an experience of radium and X-rays at the Hospital for Women, Soho Square—covering the last eighteen years, and also upon a study of the principal contributions to the literature of this subject during the last ten years.

TABLE I.—RADIOTHERAPY IN BENIGN GYNÆCOLOGICAL DISORDERS.

(1) Menorrhagia at or near menopause
Small sub-group of intractable dysmenorrhœa } *Castration doses* (Large measure of agreement
(2) Fibroids
(3) Sub-castration doses for menorrhagia
(4) Stimulation irradiation (so-called) of ovaries and pituitary—
Amenorrhœa
Irregular amenorrhœa
Menorrhagia } *Stimulation doses* (Less well known
Dysmenorrhœa
Sterility
Epilepsy
Migraine
Œdema
(5) Miscellaneous conditions—
(*a*) Pelvic tuberculosis
(*b*) Leukoplakia
(*c*) Pruritus vulvæ
(*d*) Mastitis
(*e*) Severe menopause uncontrolled by œstrin
(*f*) Endometriomata

At a joint meeting of our two Sections, in 1933[1], the discussion was almost entirely confined to the value of irradiation in cases of fibroids and of menorrhagia at the menopause. As a large measure of agreement on this subject was found to exist, I shall now mainly refer to those aspects of it which were not discussed at that meeting or which still seem to be controversial.

Much less is known and understood of the so-called sub-castration doses for intractable menorrhagia in young women, and less still of the very small so-called "stimulation doses" used in amenorrhœa, dysmenorrhœa, and sterility. Evidence is accumulating, so far as the pituitary gland is concerned, that even these very small doses have a destructive rather than a stimulating action.

Menopausal menorrhagia.—The advantages of irradiation over surgery for this condition are: (1) A lower mortality rate. (2) A lower morbidity rate. (3) A shorter recovery time with less physical trauma. (4) Shorter hospitalization with lessened cost.

Lower mortality rate.—I cannot find any evidence in the literature of a mortality rate associated with the use of X-rays, though there is a small but definite mortality rate associated with the use of radium. With radium it is well under 1% in a series of many thousand cases recorded, and the chief causes of death are embolism, peritonitis, and uræmia. It is difficult for a surgeon, no matter how skilled and experienced, to perform 100 abdominal operations without losing one or two cases. Pulmonary embolism is probably responsible for about 1% of operative deaths, and it cannot be foreseen or prevented. Probably fatal paralytic ileus is responsible for an equal number of deaths. I think it is a fair estimate to say that there is a mortality rate of at least 2% in cases of subtotal hysterectomy, 2–3% in cases of panhysterectomy, and a possibly higher rate in cases of myomectomy. Some recorded rates for the latter operation range from 7% upwards. The mortality rate will tend to be higher in cases of severe anæmia and will vary somewhat with the skill and experience of the surgeon, tending to higher levels in the hands of the occasional operator. Ford, of the Mayo Clinic, had a mortality rate of 0·8% in 250 operations for fibroids. Miss Louisa Martindale's mortality rate for myomectomy cases was 7%.

Lower morbidity rate.—Probably 10% of abdominal operations cause us varying degrees of anxiety owing to complications. Although X-rays, especially if given over a period of time are apparently free from complications, radium appears to have a definite morbidity rate chiefly due to local reactions, but even so, such morbidity is not so serious as in surgically treated cases. Pyometra occasionally occur, and a persistent watery discharge for from three to six months after radium insertion into the uterus is not uncommon. Probably both are the result of burns or necrotic injuries to the endometrium, the discharge lasting until healing is complete. Dannreuther gives the incidence of discharge as 25%, Broido as 50%. Pelvic peritonitis and broad-ligament abscesses occur occasionally, especially in cases of repeated insertion of radium, and when small inflammatory foci in the pelvis have been overlooked. One authority in a series of cases had five pelvic abscesses.

Intestinal obstruction is more likely to occur if the patient has had a previous pelvic operation such as a myomectomy. It is doubtless due to the effect of the rays upon a loop of intestine adherent to the uterus.

Pain in the groin is not an uncommon sequel, and œdema of the leg or ankle—presumably the result of injury to pelvic veins—occasionally occurs. Some patients complain of diarrhœa immediately after the treatment, and of subsequent constipation—probably this is an effect of the radium on the glands of the rectal mucosa. It is as well to warn patients of such possible, though usually transient, troubles.

An ideal case for X-ray treatment would be found in the woman of 45 or over, who is a bad anæsthetic risk, who suffers from hæmorrhage sufficient to produce anæmia, for whom medical and endocrine treatments have been tried and failed, and in whom no gross abnormality can be found in the pelvic organs. Radium would be

[1] *Proceedings*, **26**, 637.

preferable to X-rays, if the above patient were a good anæsthetic risk. It has the advantage of excluding the possible presence of carcinoma or fibroid polypi, because of the technique involved in its insertion.

Women under 40—and certainly women under 35—are better treated by a subtotal or fundic hysterectomy (both of which conserve ovarian function). Women over 40 with a laceration of the cervix and vaginal prolapse are often best treated by vaginal hysterectomy, which carries only a small risk and cures the prolapse and discharge in addition to the bleeding.

TABLE II.

Conditions irradiated by mistake—

(*a*) *Pelvis*	Carcinoma of sigmoid	
	Diverticulitis	For fibroid
	Extra-uterine pregnancy	
	Inflammatory pelvic mass	
	Carcinoma of cervix and fundus	
	Pregnant uterus	Menorrhagia
	Threatened miscarriage	
	Carneous and vesicular mole	
(*b*) *Blood diseases*	Purpura	
	Pernicious anæmia	Menorrhagia
	Aplastic anæmia	
(*c*) *Other (non-pelvic) diseases*	Mitral stenosis	
	Chronic pulmonary D.	Menorrhagia
	Arteriosclerosis	
	Graves' disease	

Investigations which may be necessary before irradiation is carried out—

(*a*) Examination of heart, lungs, abdomen, blood-pressure.
(*b*) Differential blood-count. Coagulation-time.
(*c*) Basal metabolic rate (occasionally).
(*d*) Bimanual examination (differential diagnosis of pelvic masses).
(*e*) Occult blood. Barium meal or enema. Sigmoidoscopy. (Left-sided pelvic swellings especially in women over 40.)
(*f*) Zondek test. Young women with irregular hæmorrhage.
(*g*) Examination under anæsthetic. Fat women : Doubtful diagnosis.
(*h*) Dilatation and curettage. Excludes carcinoma and fibroid polypi.

Dosage and filtration.—There is some difference of opinion as to the best dosage. In England 2,400 mgm. hrs. is the most commonly given dose. On the Continent larger doses than this are usually given, often so large as 3,600 mgm. hrs., and there is a preference for X-rays. In America smaller doses are usual, 1,200–1,500 mgm. hrs. is very common, while 1,800 mgm. hrs. is rarely exceeded. Malpas found this also in 19 American clinics investigated. The larger doses may slightly increase the percentage of cures, but there is more risk of unpleasant local sequelæ and, probably, the minimal effective castration dose should be our aim. At the 1933 meeting at the Royal Society of Medicine some of the speakers stated that they used 50 mgm. for forty-eight hours or 75 mgm. for thirty-six hours. Probably 100 mgm. for twenty-four hours is better for the patient because it entails a diminished period of backache, burning feeling, nausea, and vomiting, which are usually present while the radium is in the uterus. The question of filtration was also raised at the 1933 discussion, and one speaker said that it was misleading to mention dosage without giving the filtration used, as the latter modified the effective dose. Norman White stated that since the Heyman technique for carcinoma of the cervix had been in use at University College Hospital, he had used the same filtration in benign cases—e.g. the equivalent of 3 mm. of lead. I give here a provocative quotation from Quinly (*American Journal of Roentgenology*) :—

"Increase of screenage above 0·3 mm. of platinum does not significantly modify the percentage of gamma rays emitted—but only reduces the intensity of the gamma rays out of all proportion to the small increase in the percentage of highly penetrating rays obtained."

Quinly concludes that 0·8 mm. of platinum is an adequate screen, combining sufficient filtration with adequate mechanical strength of the container. This is in agreement with common practice. Malpas found that 1·0 mm. of platinum was probably the most commonly used screen. Bowing, Friche, and Desjardins (Mayo Clinic) use 1·0 mm. of platinum, and Norris and Behney used 0·5 mm. of platinum till 1931, since when they have used 1·0 mm. of platinum. This screenage enables a smaller applicator to be used, so that even when covered with rubber tubing (walls 2·0 mm. in thickness) the applicator can easily be removed without the necessity of an anæsthetic.

Does radium act upon the ovaries, the endometrium, or both ?—This question is of great importance, and has not yet been satisfactorily answered. If the destructive action is chiefly upon the ovaries there is little advantage in using radium rather than X-rays—as use of the latter is not accompanied by unpleasant sequelæ. In addition radium as well as X-rays must be avoided in cases in which we wish to preserve ovarian activity. I suppose we would all say that women under 40 years of age should avoid radiotherapy and probably many of us would put the age limit at a higher figure, probably 45 years. The following table gives some of the varying views held upon this subject.

TABLE III.—VIEWS OF VARIOUS OBSERVERS AS TO ACTION OF RADIUM: WHETHER ON ENDOMETRIUM ONLY, ON OVARIES CHIEFLY, OR ON BOTH.

Observers	Conclusion effects on
Most German Clinics	Ovaries only
Zweifel	Ovaries only
Moore	Ovaries chiefly
Keene and Payne	Ovaries only
Clark and Norris	Ovaries only
Forsdike	Endometrium almost entirely (from clinical, pathological, and experimental evidence)
Nicotra	Endometrium chiefly
Mayo Clinic (Bowing, Friche, Desjardins)	Non-committal
Grier	Ovaries and endometrium
Malpas (24 replies to questionnaire) ...	Ovaries only (13) Endometrium only (4) Ovaries and endometrium (7)

Forsdike, the main protagonist for endometrial action, brought forward clinical, pathological, and experimental, evidence in favour of this point of view. His slides showed destruction and fibrosis of the endometrium, whereas the sections of ovaries showed normal follicles so long as sixty days after irradiation. He maintained that the destructive range of the gamma ray was rarely beyond three-quarters of an inch of solid tissue, and that although the uterine wall was normally half an inch thick, it was often three-quarters of an inch or more in thickness. In addition, the dose of gamma rays received by an object varied inversely as the square of the distance, so that if it were assumed that the ovaries were four inches from the endometrium, they would receive only one-sixteenth of the dose received by the endometrium.

On the other hand, Clark and Norris have shown that although immediate necrosis is produced, ultimate complete recovery of the endometrium does occur—whereas the late effects upon the ovaries show complete destruction of follicles. My own opinion is that Forsdike's excellent experiments did not go quite far enough and that sections of ovaries at a later date after irradiation would have shown destruction of follicles, as in the cases of Clark and Norris.

We are all agreed that there are two main actions to be considered in irradiation both by radium and X-rays : (1) The local action causing destruction of blood-vessels and general fibrosis, and (2) the special selective action of the gamma ray upon rapidly growing cells, be they germ cells, granulosa cells, or cancer cells. The effects of radium upon the ovaries must, of course, vary in different individuals, and depend upon many conditions, such as the thickness of the uterine wall, the distance of the ovaries from

the endometrium, the age of the patient, the time in the menstrual cycle when the irradiation is given, and the degree of functional activity of the ovaries in the particular person. When all these factors are favourable and cessation of menstruation is produced, it is reasonable to assume that this result is obtained at least mainly by the action of the rays upon the ovaries. On the other hand, unfavourable conditions probably account for the percentage of failures which occur.

TABLE IV.—THE ADVANTAGES OF X-RAYS AS COMPARED WITH RADIUM.

(1) A menopause can be induced over a longer period and therefore with fewer subsequent disorders.
(2) There is no hospitalization; the patient can continue her work.
(3) There is less physical upset.
(4) X-rays are more suitable for the treatment of large tumours.
(5) X-rays may be used in cases where there is pelvic inflammation.
(6) No anæsthetic is required—X-rays are therefore suitable for patients having diabetes, mitral stenosis, &c.
(7) There are no unpleasant local sequelæ (discharge, &c.).
(8) The mortality rate is nil, or almost nil. Occasional deaths occur with radium from embolism—peritonitis, &c.

ADVANTAGES OF RADIUM.

(1) Examination under anæsthetic is valuable in doubtful cases and for stout patients. (Note, however, that this may be made and X-rays given later.)
(2) Preliminary dilatation and curettage excludes carcinoma and sloughing fibroid polypi. (Again this may also be carried out and X-rays given later.)
(3) There is probably less destruction of ovarian tissue and activity.

The main argument in favour of the use of radium rather than X-rays is that its effect upon the ovaries is probably less destructive. If this is not so, there is little to recommend it as against X-rays, in face of the eight advantages of X-rays given above. It is true that it is easy to insert radium while the patient is still under the anæsthetic necessary for the diagnostic curettage which most of us think is a *sine qua non*. On the other hand it entails one or more days of sickness and discomfort, and probably unpleasant after-effects, none of which follows the use of X-rays. After all, if X-rays are safer for the patient, it is obviously better to allow her to come out of the anæsthetic and to give the X-rays a little later. The question should depend upon the relative merits of the two treatments and not upon a matter of convenience during a diagnostic curettage.

TABLE V.—MENOPAUSAL SYMPTOMS WITH RADIATION.

Discomforts with surgical menopause	Discomforts with radiation menopause	Discomforts at menopause in normal women
Martindale: 42% complained of flushes	Norris and Behney 59·7 (967 cases) Dannreuther 40% (severe in 18%) Keene and Payne 30% Martindale 36% Malpas 23%	Barrett: 1,000 normal women studied 15·8% free from symptoms; 20% complained of flushes; 89·7% able to carry on usual work (*8th French Congress of Obstetrics and Gynæcology*)

There is general agreement amongst both radiologists and gynæcologists regarding the question of the severity and frequency of menopausal symptoms after irradiation, in comparison with those which follow the normal and the surgically-produced menopause. Most of us think that irradiation antedates the menopause symptoms, but probably increases their intensity to a slight extent only. The symptoms are often most severe in women between 30 and 40 years of age. It is not an easy matter to destroy beyond repair the ovarian function of women under 30—which probably accounts for the less severe disturbances which we so often meet in women under this age after comparatively large doses of radium or X-rays.

TABLE VI.—FIBROIDS AND MENOPAUSAL MENORRHAGIA (RADIATED CASES).

Name	No. of cases	Cured %	Mortality %	Subsequent operation %	Subsequent carcinoma %
Doderlein Clinic	408	97			
Ford (Mayo)	245	86·3	0·29	13·7	
Schmitz	433	98·6	0·86	0·2	
Moore	396	95·8	Nil	2·1	3
Crutchfield	286		0·34 (embolism)		2
Cleland	200	99·5	0·5 (embolism)		
Neill (Howard Kelly Clinic) ...	741	95·6	Nil	4·4	
Clark and Keene	476	96	0·18 (embolism)	3·7	
Phaneuf	150	97	Nil	1·2	
Zweifel	408	96·9			3·1
Corscaden	393	91·6			1·3
Bridenbaugh	309	99		1	
Williams	160	95·6	0·6		0·6
Norris and Behney	1,437	83·5	0·27	3	1·1
Stacy and Mussey (Mayo Clinic)	244	98·8		1·2	
Phillips (fibroids only)	171	95·4	Nil	4·5	Nil
Malpas	200	97·8	Nil	1	0·5
Martindale	263	94·2		5·3	1·9
Donaldson (St. Bartholomew's) ...	92	96·3			
Donaldson (Mount Vernon) ...	85	98			
	7,097				

Williams says that 50,000 irradiated cases have been collected, with a cure-rate of 90% : Portmann says that 20,000 cases of irradiated fibroids have been collected, with satisfactory results in 95% ; Malpas gives a record of 15 authors with 2,183 cases with satisfactory results.
The series above tabulates over 7,000 cases with a 95% cure rate.

The above table is made up of cases of fibroids and menopausal menorrhagia. The authors do not always state the proportions of each, so that two separate columns, one for fibroids and one for menorrhagia, have been impossible to arrange. As far as I was able to judge it is likely that more than one half of the cases are of menopausal menorrhagia treated with radium. It will be seen that there are over 7,000 cases in this table—with an average cure rate of 95% and where stated (12 authors) the mortality rate is invariably under 1% and has an average of 0·25%. Three fatal cases of embolism occurred in radium-treated cases, one in each of three separate series.

TABLE VII.—FIBROIDS (CONTRA-INDICATIONS TO RADIATION).

Finzi (1933)

(1) Women under 40
(2) Associated with carcinoma
(3) Associated with inflammation (radium only)
(4) Sloughing or extruded fibroids
(5) Calcification

Bowing, Friche, and Desjardins

(1-5) As in column 1
(6) Very large fibroids (shrink less; more failures; carcinoma or ovarian tumour may be missed)
(7) Rapidly-growing fibroids (risk of degeneration)
(8) Anæmia out of proportion to hæmorrhage (? carcinoma; ? degeneration; ? other diseases)
(9) Pain a marked feature (? degeneration; ? malignant disease)
(10) Extra-uterine pelvic tumours
(11) Psychological causes (cancerphobia, radiophobia)

Norris and Behney

(1-11) As in column 2
(12) Pressure symptoms (immediate relief required)
(13) Doubt in diagnosis
(14) Cervical fibroids
(15) Previous abdominal operation (risk of obstruction if bowel is adherent and radium is used)
(16) After menopause
(17) Pregnancy

Béclère says that fibroids always constitute an indication for radiation. Williams, at the 21st Annual Meeting of the Radiological Society of North America, said that he had been "forced to take more and more contra-indicated cases, and with excellent results. Many of these contra-indications would be belied by individual radiologists".

Keene says that in women aged up to 30, normal menstruation was restored in 88%; amenorrhœa developed in 6%; severe menopause in 8%; no deaths; phlebitis in 1 case.

Comments on Subcastration Doses

(1) The method is one of trial and error.

(2) The initial dose is 150–300 mgm hrs. Second dose 300–500 mgm. hrs. Maximum 800 mgm. hrs. (possibly 600 mgm. hrs.).

(3) It should be regarded as a temporary method pending further advances in endocrinology.

(4) It should only be tried after all else has failed. Patient must be very anæmic for radiation treatment to be strongly indicated. *Treatment which should first be tried:* Calcium therapy; progestin; antuitrin S.; thyroid; dilatation and curettage; blood transfusion; ¼ skin dose, irradiation of spleen (2 to 4 doses—three to four weeks between).

(5) Disadvantages: Difficulty in correlating dose and effects; produces lengthened cycle rather than lessened loss in many cases; danger of producing amenorrhœa, especially in women 30–40 years of age (the younger the woman the shorter the period of amenorrhœa).

(6) No danger to future labour from cervical scarring (Murphy 402 cases).

(7) No danger of deformity or abnormality of the fœtus in pre-conceptional radiation: (1) Murphy 1·1% deformities in 600 irradiated cases followed up; (2) Malpas 2·1% deformities in 14,000 normal deliveries; (3) Matthews irradiated ovaries of animals up to 800 mgm. hrs. in 2 doses and followed up the results for 15 to 20 generations; he found no increase in the percentage of abnormalities and deformities.

Malpas made inquiries of 32 leading European, English, and American clinics; 12 of the chiefs used radium; 20 were definitely opposed to its use.

Effects of radiation on subsequent pregnancies.—Grier says there is some evidence to show that irradiation of the ovaries in animals, if followed by pregnancy, is likely to result in retardation of growth and lack of resistance in the first generation and in sterility and deformity in the second generation. With regard to human beings, more knowledge and research are needed on this subject.

The work of Murphy and Matthews regarding the risks to mother and offspring in future pregnancies following pre-conception irradiation has received world-wide recognition, and has done much to banish the fear which has for so long deterred us from giving even small doses of radium and X-rays to young women.

I have included a quotation from Grier, which with others of a like nature shows that some authorities hold that the use of radiation in this type of case is not yet free from risk, and that more experience and research are necessary before this type of treatment can be made applicable for general use.

Stimulating irradiation of pituitary and ovaries (so-called).—Werner in 1927 in the *American Journal of Obstetrics and Gynæcology* reported successful cases and subsequent pregnancies. Rubin in 1927 reported similar successful cases. Rongy in 1927 reported 22 successes in 36 cases and eight subsequent pregnancies. He advanced the view that "success in amenorrhœa and sterility cases may be the result of destruction of a persistent corpus luteum".

Recent reports: Ford 76 cases; Mazer and Spitz 99 (really 102, but 99 only followed up); Phillips and Berry 100 (this the first publication).

The above cases make a total of 311, including Rongy's series of 36 cases.

We have for long been familiar with pituitary irradiation in cases of pituitary tumour, but have proceeded cautiously with regard to ovarian irradiation, through fear of producing amenorrhœa or abnormal offspring. In an editorial in the *Lancet*, October, 1937, it was pointed out that it is doubtful whether the term "stimulating dose" can be rightly applied to these small doses of X-rays—and certainly with regard to the pituitary gland there is much evidence against the existence of a so-called stimulating dose. Possibly a destructive action is followed by a temporary compensatory increase in secretion. In any case the name is here retained as denoting

a well-known technique, until further pathological knowledge enables a more accurate name to be applied.

F. Ford of the Mayo Clinic reports 76 cases treated by pituitary and ovarian stimulation, from 1927 to 1931. Ford thinks that pituitary and ovarian stimulation are of equal value in amenorrhœa, and that combined radiation is better than ovarian only. 47 of the cases were treated for amenorrhœa, partial amenorrhœa, and associated sterility; the ages varied from 19 to 37 years. All except two had one dose only; five had pituitary stimulation only, 36 had ovarian stimulation only, and six had both ovarian and pituitary stimulation. The results showed a cure rate of 55%. 26 cases developed regular periods up to two years or more, and seven pregnancies occurred in six of 24 married women previously sterile.

29 cases of dysmenorrhœa were also treated; seven had pituitary stimulation alone, three had ovarian stimulation alone, and 19 had both. Results: 18 of the 29 cases (62%) were relieved for periods up to three and a half years. The loss at the periods and the cycle were unchanged. Eleven cases were unaffected by the treatment.

Technique: Ford gave from 15 to 20% of an erythema dose, and assumed that 5 to 10% of an erythema dose reached the ovaries. 200 K.V.—0·75 mm. Cu and 1 mm. Al filter were used to each of two abdominal fields 8 × 10 cm. over each ovary. In pituitary radiation, two fields of 5 × 5 cm. over each temporal area, and 15 to 20% of an erythema dose to each field, were used. Thaler reports good results from 18 to 23% of an erythema dose. Werner reports a 30% erythema dose to each field. As a rule better results are obtained in obese patients especially under 33 years of age. A long period of amenorrhœa does not mean a likely failure. One treatment is usually enough in amenorrhœa but repeated doses produce better results in dysmenorrhœa.

Mazer and Spitz report 99 cases: cured 57 (57·5% improved).

Disease	No. of cases	Results	Remarks
Amenorrhœa (5-7 years) ...	48 followed up	22 Menstruation regular and normal (average 2-3 years) 4 improved 16 failed to respond 6 conceived soon after treatment: 4 of these menstruated regularly since delivery: 2 remained amenorrhœic	32 (i.e. 66%) encouraging results.
Irregular amenorrhœa (interval of 6-13 weeks, with menorrhagia) ...	21	8 regular normal menstruation 6 slightly improved 1 failed to respond 6 conceived soon after treatment: (all menstruated regularly since delivery)	14 (i.e. 66%) excellent results.
Menorrhagia	6	3 cured 2 improved 1 failed to respond	5 cured or improved out of 6 treated.
Irregular periods with short intervals and heavy losses	13	10 cured (3 years so far) 1 improved 2 failed to respond	11 cured or improved out of 13 treated.
Sterility (periods normal)	6	2 successful 4 failed	2 successes out of treated.
Scanty regular periods ...	5	Results not stated	

Of the 99 women 38 were sterile; 20 of these became pregnant. There were 26 live births and three abortions in the cases irradiated.

Dysmenorrhœa: 14 of the 99 treated had painful periods; seven were permanently cured (two of these after the birth of normal children).

Control cases: The same treatment was given to 17 women whose periods were normal—without any effect on the amount of bleeding, menstrual cycle, or general health.

Technique: 127 K.V., 5 ma.; 14 in. distance; 5 mm. Al filter. The filter varies with the size of the abdomen and the thickness of abdominal wall.

50% of the amenorrhœa cases had regular periods for one to four years. In two cases (2%) complete amenorrhœa developed. Only nine patients required one or two additional treatments and five of these were cured.

100 *cases from the Hospital for Women* (*Phillips and Berry*).—In 81 cases small doses were applied to the pituitary gland; 50 of these were cases of amenorrhœa, of which 10% were cured. The following are the details:—

No. of cases	Duration of amenorrhœa	Failures	Improved	Cured
5	Primary	5	—	—
9	3-7 years	3	5	1
7	2-3 „	5	2	0
7	1-2 „	4	2	1
14	Up to 1 year	6	5	3
8	Irregular	2	6	0
		25 (50%)	20 (40%)	10%

The improved cases are not a satisfactory group, as a short improvement was followed as a rule by relapse. The group is disappointing on the whole, as there were only 10% of cures. There was, however, a marked improvement with regard to headaches when these had been present, and in the general condition of the patient in a large number of cases. Most cases had six treatments, one a month for six months.

Thirty-one cases were treated for dysmenorrhœa, sterility, menorrhagia, and epilepsy, and of these 18 were definitely helped (i.e. 58%). The group shows better results than those obtained in the amenorrhœa cases. The results are seen as follows:—

	Cases	Failures	Improved	Cured
Dysmenorrhœa	13	2	3	8
Sterility	9	9	—	—
Menorrhagia	3	1	1	1
Epilepsy	6	0	5 (much improved)	1 (able to marry)

Ovarian stimulation (*so-called*).—Only nine cases have so far been treated in this way, seven in married and two in single women. Three cases were treated for sterility of a most intractable kind in which all other treatments had failed. Two of the patients became pregnant and were delivered of normal children. Four patients were treated for amenorrhœa with one success and three failures. Two were treated for dysmenorrhœa, with one success and one failure. In this small group there were 44% of successes. I have been impressed with the good results in sterility cases both in my own cases and in the literature, and I intend to use this method much more in the future.

Combined pituitary and ovarian stimulation.—Only 10 cases fall into this group, five in single and five in married women. There were two cases of sterility, both intractable, and in both treatment was successful and the patients have borne normal children. There were five amenorrhœa cases—all failures. In two cases of menorrhagia and dysmenorrhœa a cure of the menorrhagia followed pituitary stimulation and a cure of the dysmenorrhœa followed ovarian stimulation. One case of irregular menstruation was much improved. In all, there were 50% of successes in the above small group, but all the amenorrhœa cases were failures. The results recorded in the above series of cases tend to show that there is a place for this type of treatment in

some cases of amenorrhœa, menorrhagia, dysmenorrhœa, and sterility, and that even if no success follows the treatment, no harm will be done.

MISCELLANEOUS INDICATIONS: 78 CASES.

(*Hospital for Women*)

Disease	Number	Results	Technique
Tuberculous peritonitis	5	4 much benefited	1 treatment; 800 "r"; 46 cm.; 0·5 Cu
Leucoplakia (Mostly post-menopausal) very disappointing	25	1 cured 17 lost sight of but 14 were improving a little 7 failed	200-400 "r" repeated; 33-46 cm.; 0·5 Cu
Pruritus (No obvious cause)	27	10 cured 1 improved 1 failed (15 lost sight of but all improving)	1-4 treatments; 200-400 "r"; 33-46 cm.; 0·5 Cu
Mastitis (Mostly advanced cases with discharge or bleeding from nipple)	21	16 cured 1 failed (4 lost sight of but improving)	Mostly 1 treatment; 500-1,000 "r"; 46 cm. 0·5 Cu; 1 or more fields

The cases of tuberculous peritonitis, suitable for X-ray treatment, are not those of the discrete circumscribed pelvic masses capable of removal, but rather those in which complete excision of all pelvic or abdominal foci is impossible. Sometimes there are such dense and manifold adhesions that heroic surgery results only in bowel injury and fæcal fistulæ which, when tuberculous, rarely heal. The valuable results in mastitis and pruritus are too well known to need amplification. The results in leucoplakia cases are very disappointing, and I have now abandoned X-ray treatment for this troublesome and resistant disease of the vulva.

Pituitary irradiation in cases with severe menopausal symptoms uncontrolled by œstrin.—In some cases with severe flushes and other symptoms, œstrin is recovered in normal amounts from the urine, and the administration of this hormone is without beneficial effect. It is well known that castration may be followed by an increase in the size of the anterior pituitary, and oversecretion of prolan. Collins reports 33 cases—all severe—all cured by pituitary irradiation, except one case (dementia præcox) included as an experiment. Borsk reviews a series of 274 cases with 80% cures, many observed over six years. (In control cases in which lead screens were used to prevent penetration of the rays, the menopausal symptoms remained unaltered.) Relief is usually obtained in one to six weeks from the first exposure, and is usually noticeable in three weeks.

Endometriomata.—There is scope for the use of X-rays or radium in these cases, but it is definitely limited. Irradiation is effective in these cases only if it is given in castration doses; this seems to be generally admitted. Unfortunately, many of our patients with endometriomata are sterile women between 30 and 40 years of age, having an acquired dysmenorrhœa and menorrhagia, and they wish to be left with a chance of conception at all costs. Large doses of irradiation are not often desirable in such cases. Secondly it is difficult, and often impossible until the abdomen is opened, to diagnose chocolate cysts and conditions in which endometrial islets have produced matting and fixation of pelvic organs. Surgery in such cases offers the best chance of conservative treatment, as it is often possible to excise chocolate cysts and endometrial foci and at the same time to preserve portions of each ovary. Irradiation as an alternative would destroy all ovarian activity. There is one type of case for which irradiation is eminently suitable, namely that in which the endometrial activity is confined to the bottom of the pouch of Douglas—the so-called endometrioma of the recto-vaginal septum. In these cases excision would entail a pan-hysterectomy, and would leave the anterior surface of the rectum raw, and possibly still covered with

endometrial foci. It is better in such cases (and this has been my practice for some years now) to close the abdomen and irradiate the septum with radium inserted into the uterus or cervix. So far as I can tell up to the time of writing, the results of this treatment are satisfactory.

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Dr. Malcolm Donaldson said that before he had heard Mr. Phillips' paper he had thought that the question of radiotherapy in gynæcology had been thoroughly worked out and that the indications could be dogmatically stated. On the other hand he still felt that a great deal of the work which had been mentioned, namely, the treatment of conditions during the child-bearing term of life by small doses of radium, could only be justified if it was proved that small doses reaching the ovaries did not in any way injure the ovum and thus affect the offspring of the irradiated patient in the first and second generations following the irradiation. Work by geneticists had shown how in insects and in unicellular organisms very marked effects could be brought about by very small doses of irradiation. Further, even in the case of rabbits, Lacassagne had shown that the offspring of irradiated animals were often stillborn. On these grounds he (Dr. Donaldson) had restricted radiological treatment for non-malignant gynæcological conditions to patients over 40.

As diagnostic curettage was essential in cases of irregular bleeding, it was unnecessary to apply X-rays when a 50 mgm. tube could be inserted and achieve the same object. He was convinced that X-rays and radium acted by destroying the ovarian follicles. In cases of fibroids, it was his practice to restrict radium treatment to cases in which the tumour was no larger than a full-time fœtal head.

During the last five or six years Dr. Moore Patterson had followed up and investigated all the cases of non-malignant gynæcological conditions treated at Mount Vernon Hospital. As a result of sending out a questionnaire and personally interviewing these patients, Dr. Patterson had drawn up statistics of the symptoms following an artificial menopause. He had compared the number of patients suffering from symptoms with those who had had a natural menopause or oophorectomy. The difficulty of getting statistics of this latter class of case was very great. [Dr. Donaldson showed tables giving the results obtained by Dr. A. A. Werner, published in the *Journal of the Missouri State Medical Association*, and comparing them with those obtained in the cases which had been treated by radium (Tables I to IV).]

TABLE I.—FREQENCY OF NERVOUS SYMPTOMS.

	Natural menopause 96 %	Oophorectomy 40 %	Artificial menopause 136 %
Irritability	61·4	67·5	26
Decreased concentration and some loss of memory	54·1	52·5	18
Depression and fits of crying	60·4	62·5	21
Sleep—not so well or disturbed	59·3	62·5	12
Severe headaches	37·5	50	16

TABLE II.—FREQUENCY OF CIRCULATORY SYMPTOMS.

	Natural menopause 96 %	Oophorectomy 40 %	Artificial menopause 136 %
Hot flushes	91·6	92·5	52
Palpitations	72·9	47·5	21
Breathlessness	72·9	47·5	23
Coldness and numbness of limbs	50	40	14

TABLE III.—FREQUENCY OF GENERAL SYMPTOMS.

	Natural menopause 96 %	Oophorectomy 40 %	Artificial menopause 136 %
Lassitude and fatigue	78·1	75	12
Constipation	72·9	72·5	7
Weight—Increase	45·8	37·5	42
Loss	—	—	6

TABLE IV.—FREQUENCY OF SEXUAL SYMPTOMS.

Dyspareunia	...	...	12
Frigidity	...	...	14
Loss of sexual desire	...	...	34
Increase ,, ,,	...	...	2
Increase followed by decrease	...	..	2
Decrease but still present	...	...	13
No change	...	...	17

It would seem from these tables that with the exception of the question of "increase in weight" the patients who had an artificial menopause suffered less in the way of symptoms than those who had a natural menopause or a menopause brought about by oophorectomy.

Miss Louisa Martindale said that her own experience had been gained from her treatment of 878 cases of metropathia hæmorrhagica, fibrosis uteri, and fibromyomata of the uterus, and a certain number of cases of pruritus vulvæ, and tuberculosis of the tubes and pelvic peritoneum.

TABLE I.—METHOD OF TREATMENT IN 878 CASES OF MY OWN OF METROPATHIA HÆMORRHAGICA, FIBROSIS UTERI, AND FIBROMYOMATA, 1914-1937.

Treatment	No. of cases	% cases	Mortality
Surgical operation: ... ... (Hysterectomy or myomectomy)	471	53·64	1·9%
Irradiation: ... ... Deep X-ray therapy, 298: Radium, 109	407	46·36	0
Total	878		

In 471 cases she had performed hysterectomy or myomectomy. These were cases in which: (1) The fibroid uterus was larger than the size of a four months' pregnancy, or (2) there had recently been a rapid increase in the size of the tumour, suggesting sarcomatous or benign degeneration, or (3) a pedunculated fibroid had been present, either subperitoneal or submucous, or (4) there had been necrobiosis or calcification (shown by X-ray examination), or (5) there were severe pressure symptoms, or (6) pain had been present, suggesting additional lesions, or (7) there had been the co-existence of a pregnancy, or (8) most important of all, metrorrhagia had been present with possible malignant degeneration of the endometrium, or fibroid, or (9) metrorrhagia with possible neoplasm of ovary or tube.

In other words, she had operated on 53·64% of her cases,[2] a high percentage compared to that of some workers (*see* Table II). These were her worst cases—which may have accounted for the somewhat high mortality rate of 1·9% (Table III).

TABLE II.—CHOICE OF TREATMENT BY VARIOUS GYNÆCOLOGISTS WORKING IN CLINICS WHERE BOTH X-RAY AND RADIUM THERAPY WERE AVAILABLE.

Surgeon	No. of cases treated	% in which surgical operations performed
Polak	906	77
Neill of Baltimore	—	75
Martindale	878	53·64
P. Werner	—	50
Gal	—	45
Zweifel (Doederlein)	—	21
Seitz and Wintz	—	16
Gauss (Würzburg)	1,048	15

[2] Preliminary diagnostic dilatation and curettage done in a large number of the X-rayed cases were not included.

TABLE III.—RESULTS IN 471 CASES TREATED BY SURGICAL OPERATION, 1914-1937.

	No. of cases		Died	Cases complicated by: Carcinoma	Sarcoma	Carcinoma of other pelvic organs	Pregnancy
Subtotal hysterectomy only ...	203			1			
Subtotal hysterectomy and oophorectomy	105	335	3* viz. 0·89%	2	2	2	
Subtotal hysterectomy and double oophorectomy	27				1	1	
Total hysterectomy only	32						
Total hysterectomy and oophorectomy	19	60	1 viz. 1·66%	6	2		
Total hysterectomy and double oophorectomy	9						
Abdominal myomectomy only ...	38		4				2
Abdominal myomectomy and oophorectomy	15	54					
Abdominal myomectomy and double oophorectomy	1						
Vaginal myomectomy	22	22	1†				2
Totals ...		471	9	9	5	3	4

* One seven days after operation, of delayed chloroform poisoning.

† The patient was ill at the time of operation. She had morbus cordis and a large degenerating fibromyoma. She died three days later.

The technique used since 1919 in her treatment by deep X-ray therapy was as follows :—

The patient was carefully prepared as for abdominal operation, after full blood and urine tests. At a voltage of 186,000, with two anterior and two posterior ports of entry, 8 × 10 cm. in size, at a focal distance of 30 cm. (or two large fields at 50 cm.), with a filter of 0·5 mm., Cu, and 2 mm. Al, at 3 ma., a full unit skin dose to the skin was obtained on each area. The full time of treatment lasted from sixty-four to seventy-two minutes under these conditions, and one treatment alone was sufficient to attain an artificial menopause.

Table IV gave the results of an analysis following a careful follow-up, and proved that the risk of malignant disease occurring in an irradiated uterus was no greater than—if as great as—the risk of a carcinoma occurring in it or in any other organ of the body in a case which had not had X-ray irradiation ; and the menopausal symptoms were no greater than those of the normal climacteric.

TABLE IV.—RESULTS OF 298 CASES TREATED BY X-RAY THERAPY, 1914-1937.

Number of cases	Cured	Not cured	Not traced	% not cured	Non-malignant	Hysterectomy subsequently performed: Malignant	Operations performed subsequently for disease of other organs: Non-malignant	Malignant
63 (ages 25-40) / 235 (ages 41-58)	279	11	8	3·7	10*	5 1 C. of C. 15 years after 2 C. of F. 7 years after 3 C. of F. 3 years after 4 Sarcoma of fibroid 5 years after 5 C. of C. 1 year after	5 1 Ov. cyst 2 Ov. cyst 3 Cholecystectomy 4 Cyst of breast 5 Thyroidectomy and appendicectomy	7 1 C. of ovary 2 C. of stomach 3 C. of breast 4 C. of breast 5 C. of breast 6 C. of kidneys 7 C. of abdomen
298	279	11	8	3·7	10	5	5	7

* Operation showed in 6 of these cases that further X-ray therapy would have been sufficient.

TABLE V.—END-RESULTS OF CASES TREATED FOR MYOMATA AND PRE-CLIMACTERIC METROPATHIA, BY OPERATION AND IRRADIATION. WÜRZBURGER UNIVERSITÄTS-KLINIK.

Method	Menopausal symptoms, particularly vasomotor		Deterioration of memory		Emotional disturbance		Decrease of sexual feeling		Increase of weight	
	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
A. Removal of functioning part of uterus and one ovary	248	79·6	244	23·4	246	17·9	85	36·5	153	57·3
B. Removal of functioning part of uterus and both ovaries	102	76·5	96	34·4	100	26·0	45	40·0	78	65·6
C. Uterus and ovaries irradiated, amenorrhœa resulting	100	83·0	100	1·0	100	4·0	0	?	100	68·0

Table V showed a similar series of cases, in which Gauss had collected end-results.[3] In these, the menopausal symptoms of X-rayed cases were only slightly greater than these in operated cases, whereas loss of memory, mental depression, and loss of sexual feeling were practically non-existent in the X-rayed cases. She emphasized the advantages of X-ray therapy over radiotherapy, and pointed out that :—

(1) With X-ray therapy, the mortality was nil. With radiotherapy, there was a mortality of from 0·3% to 2%.

(2) With X-ray therapy there were no resulting complications such as cystitis, pyometra, post-operative radionecrosis, with prolonged leucorrhœal discharge, vaginitis, or dyspareunia.

(3) The method was applicable to fibroids if interstitial, and the size of a four months' pregnancy. In such cases the dose of radium had to be very large, and might be followed by radionecrosis.

(4) The results were more certain.

(5) There was no fear of setting up a purulent salpingitis or peritonitis in the presence of a latent infection.

(6) There was no fear of a stenosed cervix. (Two cases recently reported had Cæsarean section.)

(7) There was no evidence that preconceptional X-ray irradiation was harmful to pregnancy, parturition, or the physical and mental development of the child.

The advantages of radiotherapy over X-ray therapy were fewer :—

(1) The cessation of hæmorrhage was certainly quicker. In a very anæmic patient this was important, though, in such a case, if the blood-count was as low as two million reds, with hæmoglobin of 18 to 25%, she gives one or two blood transfusions first.

(2) If dilatation and curettage were imperative, it was simpler and easier to apply radium at once.

There still remained, according to her own experience, 53% of cases in which surgical operation was the method of choice, especially in all cases of doubtful diagnosis, in all cases of giant fibroids, subperitoneal and submucous fibroids, or co-existing pregnancy, and also in the case of young patients, for whom a myomectomy was all that was required.

[3] *Strahlentherapie*, November 1937.